ST. MARY'S COLLEGE (Autonomous)

(Re-accredited with 'A^{+}' Grade by NAAC)

Thoothukudi-628001, Tamil Nadu

(Affiliated to Manonmaniam Sundaranar University)

B.Sc. Chemistry

School of Physical Sciences

Outcome Based Curriculum

(W.e.f.2023)

Preamble:

Chemistry is a branch of Physical Science that deals with the composition, structure, behavior and properties of matter. Chemistry is at the center of our knowledge of the physical world around us. Each of us feels the impact of Chemistry in everyday of our lives.

Vision:

To produce knowledgeable Chemists and educate future scientists to enhance services to the community.

Mission:

To equip the students with the conceptual and experimental tools for the holistic development of professional graduates in academia, industry and government to meet the global environmental issues through chemical education.

PROGRAMME OUTCOMES (PO) OF B.SC DEGREE PROGRAMME IN CHEMISTRY

PO No.	**After completion of the Undergraduate programme the students of St. Mary's College will be able to**
PO 1	acquire an in-depth domain knowledge and a comprehensive knowledge of various disciplines to become skilled professionals
PO 2	enrich their communicative skills, and enhance their creative, numerical, analytical and problem solving skills
PO 3	gain potential skills to excel indigital literacy, team management, scientific reasoning, research and self-directed life-long learning to emerge as entrepreneurs
PO 4	be aware of the environment with a social responsibility for the well-being of humanity and the planet at large
PO 5	be an empowered, economically independent woman with a global perspective to emerge holistically in the egalitarian society

PROGRAMME SPECIFIC OUTCOMES

PSO No.	After completion of the B.Sc. degree in Chemistry, the students of St. Mary's College will be able to	PO Addressed
PSO1	Acquire in-depth knowledge of the fundamental concepts in organic, inorganic and physical chemistry.	PO 1
PSO2	Develop creativity in academics and research and apply digital tools to collect, analyse and interpret data and present scientific findings.	PO2
PSO3	Gain competence to pursue higher education and career opportunities in chemistry and allied fields.	PO3
PSO4	Exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.	PO 4
PSO5	Apply the concepts of chemistry to solve problems in the educational, industrial, entrepreneurial pursuits and contribute towards the holistic development of self and community.	PO 5

Semester I

Part	Components	Course Code	Course Title	Hours / Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	23ULTA11 23ULFA11	இக்கால இலக்கியம் : (செய்யுள், இலக்கணம், இலக்கிய வரலாறு, சிறுகதை) Foundation Course French I	6	3	25	75	100
II	General English	23UGEN11	Poetry, Prose, Extensive Reading and Communicative English I	6	3	25	75	100
III	Core I	23UCHC11	General Chemistry I	5	5	25	75	100
	Core Practical I	23UCHCR1	Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations	3	3	40	60	100
	Generic Elective I	23UBOE11/ 23UMAE11	Fundamentals of Botany I / Mathematics I	4 6	4 5	25	75	100
	Generic Elective Practical I	23UBOER1	Fundamental of Botany practical I	2	1	40	60	100
IV	Skill Enhancement Course I (Discipline Specific)	23UCHSE1	Role of Chemistry in Daily Life	2	2	20	30	50
	Foundation Course	23UCHF11	Fundamental Concepts in Chemistry	2	2	20	30	50
			Total	**30**	**23**			

Semester II

Part	Components	Course Code	Course Title	Hours / Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	23ULTA21 23ULFA21	சமய இலக்கியங்கள் : (செய்யுள், இலக்கணம், இலக்கிய வரலாறு) Foundation Course: French II	6	3	25	75	100
II	General English	23UGEN21	Poetry, Prose, Extensive Reading, and Communicative English II	6	3	25	75	100
III	Core II	23UCHC21	General Chemistry II	5	5	25	75	100
	Core Practical II	23UCHCR2	Qualitative Organic Analysis and Preparation of Organic Compounds	3	3	40	60	100
	Generic Elective II	23UBOE21/ 23UMAE21	Fundamental of Botany Paper II/ Mathematics II	4/6	4/5	25	75	100
	Generic Elective Practical II	23UBOER2	Fundamental of Botany Practical II	2	1	40	60	100
IV	Skill Enhancement Course II (Discipline Specific)	23UCHSE2	Dairy Chemistry	2	2	20	30	50
	Skill Enhancement Course III	23UCHSE3	Cosmetics and Personal Grooming	2	2	20	30	50
			Total	**30**	**23**			

Semester III

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	23ULTA31 23ULFA31	காப்பிய இலக்கியங்கள் : செய்யுள், இலக்கணம், இலக்கிய வரலாறு, புதினம் French Literature and Grammar I	6	3	25	75	100
II	General English	23UGEN31	English Poetry, Prose, Extensive Reading and Communicative English III	6	3	25	75	100
III	Core III	23UCHC31	General Chemistry III	5	5	25	75	100
	Core Practical III	23UCHCR3	Semimicro Qualitative Analysis of Simple Inorganic Salts	2	2	40	60	100
	Generic Elective III	23UPHE31	Physics I	4	3	25	75	100
	Generic Elective Practical III	23UPHER3	Physics Practical I	2	1	40	60	100
	NME I	23UCHN31	Everyday Chemistry	2	2	20	30	50
IV	Skill Enhancement Course (Discipline Specific)	23UCHSE4	Soil Chemistry	2	2	20	30	50
	Ability Enhancement Course I	23UAYM31	Yoga and Meditation	1	1	20	30	50
	Self-Study/ MOOC/ Internship (Compulsory)	23UCHSS1	Chemistry for competitive exam		+2	--	50	50
Total				**30**	**22+2**			

Semester IV

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil /	23ULTA41	சங்க இலக்கியங்கள் : செய்யுள், இலக்கணம், இலக்கிய வரலாறு, நாடகம்	6	3	25	75	100
	French	23ULFA41	French Literature and Grammar II					
II	General English	23UGEN41	English Poetry, Prose, Extensive Reading and Communicative English IV	6	3	25	75	100
III	Core IV	23UCHC41	General Chemistry IV	5	5	25	75	100
	Core Practical IV	23UCHCR4	Semi-micro Qualitative Analysis of Inorganic mixture	2	2	40	60	100
	Generic Elective IV	23UPHE41	Physics II	4	3	25	75	100
	Generic Elective Practical IV	23UPHER4	Physics Practical II	2	1	40	60	100
	NME II	23UCHN41	Industrial Chemistry	2	2	20	30	50
IV	Skill Enhancement Course V (Discipline Specific)	23UCHSE5	Instrumental methods of Analysis	2	2	20	30	50
	Ability Enhancement Course (Entrepreneurial Based)	23UACH41	Entrepreneurial Skills in Chemistry	1	1	--	50	50
V	NCC NSS / Sports				1			
	CDP-Extension Activity				+1			
Total				**30**	**23+1**			

Semester V

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core V	23UCHC51	Organic Chemistry I	6	6	25	75	100
	Core VI	23UCHC52	Inorganic Chemistry I	5	5	25	75	100
	Core VII	23UCHC53	Physical Chemistry I	5	5	25	75	100
	Core Practical V	23UCHCR5	Physical Chemistry Practical I	5	3	40	60	100
	Core Practical VI	23UCHCR6	Biochemistry Practical	3	2	40	60	100
	Discipline Specific Elective I	23UCHE51/ 23UCHE52	Biochemistry / Industrial Chemistry	4	3	25	75	100
IV	Ability Enhancement Course III	23UAEV51	Environmental Studies	2	1	20	30	50
V	Self-Study/ MOOC /Internship	23UCHSS2	Applied chemistry		+2	--	50	50
Total				**30**	**25+2**			

Semester VI

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core VIII	23UCHC61	Organic Chemistry II	4	4	25	75	100
	Core IX	23UCHC62	Inorganic Chemistry II	4	4	25	75	100
	Core X	23UCHC63	Physical Chemistry II	4	4	25	75	100
	Core Practical VII	23UCHCR7	Gravimetry and Preparation of Nanoparticles	5	2	40	60	100
	Core Practical VIII	23UCHCR8	Physical Chemistry Practical II	3	2	40	60	100
	Core XI	23UCHP61	Project and Viva Voce	4	3	40	60	100
	Discipline Specific Elective II	23UCHE61/ 23UCHE62	Nanoscience / Polymer Chemistry	4	3	25	75	100
IV	Skill Enhancement Course VI	23UCHSE6	Pharmaceutical Chemistry	2	2	20	30	50
			Total	**30**	**24**			

Semester	Hours	Credits	Extra Credits
I	30	23	--
II	30	23	--
III	30	22	2
IV	30	23	1
V	30	25	2
VI	30	24	--
Total	180	140	5

Courses	Number of Courses	Hours / week	Credits	Extra Credits
Tamil / French	4	24	12	--
English	4	24	12	--
Core Theory	10	48	48	--
Core Practical	8	26	19	
Generic Elective Theory	4	16	14	--
Generic Elective Practical	4	8	4	--
Discipline Specific Elective	2	8	6	--
Group Project	1	4	3	--
Skill Enhancement Course	6	12	12	--
Ability Enhancement Course	3	4	3	--
Foundation Course	1	2	2	--
NME	2	4	4	--
Extension Activities (CDP)				+1
NCC, NSS & Sports		--	1	
Self- Study Papers (Optional)	1	--	--	+2
Self-Study Papers (Compulsory)	1	--	--	+2
Total		**180**	**140**	**5**

SEMESTER - 1			
Part – 1 பொதுத்தமிழ் தாள் - 1 இக்கால இலக்கியம் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, சிறுகதை			
23ULTA11	**Hrs/Week:6**	**Hrs/Semester: 90**	**Credits: 4**

நோக்கங்கள்

	கற்றல் நோக்கங்கள்
1	காலந்தோறும் வளர்ந்துவரும் தமிழ்க் கவிதைகளின் வடிவினையும், கருத்தோட்டத்தினையும் மாணவியர் அறிந்துகொள்வர்.
2	தமிழ் மொழியைப் பிழையின்றி எழுதவும் பேசவும் முடியும்.
3	படைப்பாற்றலை வளர்த்துக் கொள்வர்.
4	இலக்கிய வரலாற்றின் வழி மொழியின் வளர்ச்சியையும் காலந்தோறும் மாறிவரும் இலக்கியங்களின் பல்வேறு வகைகளையும் தெரிந்து கொள்வர். துறைதோறும் தமிழ் மொழியின் வளர்ச்சியை அறிவர்.
5	தன்னம்பிக்கை உருவாக்கி, வேலை வாய்ப்பிற்கான தேர்வுகளில் திறமையுடன் பங்கேற்பர்.

பாடத்திட்டத்தின் பயன்கள்

CO.NO	**இப்பாடத்திட்டம் - மாணவியரிடம்**	**அறிவாற்றல் திறன்**
CO-1	பாரதியார் காலந்தொட்டு தற்காலப் புதுக்கவிதைகள் வரை கவிதை இலக்கியம் அறிமுகப்படுத்தப்படுவதால் படைப்பாற்றல் திறன் பெறுதல்	K1
CO-2	புதுக்கவிதை வரலாற்றினை அறிந்து கொள்வர்	K2
CO-3	மொழியறிவோடு சிந்தனைத்திறன் அதிகரித்தல்	K3
CO-4	இக்கால இலக்கிய வகையினைக் கற்பதன் மூலம் படைப்பாக்கத் திறனைப் பெறுவர். தமிழ் மொழியைப் பிழையின்றி எழுதவும், புதிய கலைச் சொற்களை உருவாக்கவும் அறிந்து கொள்ளுதல்	K4
CO-5	தனிமனித, சமுதாய வாழ்க்கைச் சிக்கல்களை எதிர்கொள்ளும் நிலையை உருவாக்குகிறது.	K5

அலகு - 1

மரபுக் கவிதை **(18 மணி நேரம்)**

1. தமிழ்த் தெய்வ வணக்கம் - பெ.சுந்தரனார்
2. பெண்கள் விடுதலைக் கும்மி - பாரதியார்
3. சிறுத்தையே வெளியே வா- பாரதிதாசன்
4. புத்தரும் சிறுவனும - கவிமணி
5. ஆதிமந்தி புலம்பல - கண்ணதாசன்
6. துறைமுகம் - சுரதா
7. கடல் - தமிழ் ஒளி

அலகு - 2

புதுக்கவிதை **(18 மணி நேரம்)**

1. வீட்டுக்கொரு மரம் வளர்ப்போம - அப்துல் ரகுமான்
2. சென்ரியூ கவிதைகள - ஈரோடு தமிழன்பன்
3. பிற்சேர்க்கை - வைரமுத்து
4. வாழைமரம் - மு.மேத்தா
5. வள்ளுவம் பத்து - அறிவுமதி
6. ஆனந்த யாழை மீட்டுகிறாய - நா. முத்துக்குமார்
7. சபிக்கப்பட்ட முத்தம் - சுகிர்த ராணி
8. நீ எழுத மறுக்கும் எனது அழகு - இளம்பிறை

அலகு – 3

சிறுகதை **(18 மணி நேரம்)**

1. வாய்ச் சொற்கள் - ஜெயகாந்தன்
2. கடிதம - புதுமைப்பித்தன்
3. கரு - உமாமகேஸ்வரி
4. முள்முடி - தி.ஜானகிராமன்
5. சிதறல்கள - விழி.பா.இதயவேந்தன்
6. வீட்டின் மூலையில் சமையல் அறை - அம்பை
7. ராசப்பா - முனைவர் மி.சு.எழிலரசி
8. ஆண்டன் செக்காவ் - நாய்க்காரச் சீமாட்டி (மொழிபெயர்ப்புக் கதை)

அலகு - 4

இலக்கிய வரலாறு **(18 மணி நேரம்)**

1. 20 –ஆம் நூற்றாண்டு கவிஞர் பெருமக்கள்
2. கவிதையின் வகையும் வளர்ச்சியும்
3. தமிழ்ச் சிறுகதையின் தோற்றமும் வளர்ச்சியும்
4. மொழிபெயர்ப்புகள் தோற்றமும் வளர்ச்சியும்

அலகு - 5

மொழித்திறன் **(18 மணி நேரம்)**

1. பொருள் பொதிந்த சொற்றொடர் அமைத்தல்
2. ஓர் எழுத்து ஒரு மொழி
3. வேற்றுமை உருபுகள்
4. திணை, பால், எண், இடம்
5. கலைச்சொல்லாக்கம், மொழிபெயர்ப்பு

துணைநின்ற நூல்கள்

1. பாரதியார் படைப்புகள் - சீனி.விசுவநாதன் (பதிப்பாசிரியர்)
அலயன்ஸ் கம்பெனி
64, ராம கிருஷ்ணா சாலை
மயிலாப்பூர்
சென்னை -4.

2. பாரதிதாசன் கவிதைகள் - பேரா. இ. சுந்தரமூர்த்தி
142, ஜானி ஜான் கான் சாலை,
இராயப்பேட்டை, சென்னை – 17

3. வைரமுத்து கவிதைகள் - வைரமுத்து
திருமகள் நிலையம்
55, வெங்கட்நாராயணா சாலை
தி.நகர் சென்னை – 17.

4. ரகசியப்பூ - அப்துல் ரகுமான்
நேஷனல் பப்ளிகேஷன்
2, தியாகராய நகர்
சென்னை – 17

5. நன்னூல் - பவணந்தி முனிவர்
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

6. தமிழ் இலக்கிய வரலாறு - தமிழ்த்துறை தொகுப்பு
தூய மரியன்னை கல்லூரி (தன்னாட்சி), தூத்துக்குடி.

பார்வை நூல்கள்

1. நன்னூல் - பவணந்தி முனிவர்
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

2 தமிழ் இலக்கிய வரலாறு - ச.வே.சுப்பிரமணியன்
மணிவாசகர் பதிப்பகம்
31, சிங்கர் தெரு
பாரிமுனை, சென்னை – 18.

3. சிறுகதைக் களஞ்சியம் - அ.சிதம்பரநாதச் செட்டியார் (தொகுப்பாசிரியர்)
புக்ஸ் (இந்தியா) பிரைவேட்.,
சென்னை – 1.

இணைய ஆதாரங்கள்

1. Project Madurai –www.projectmadurai.org
2. Tamil Universal Digital Library – www.ulib.prg<http://www.ulib.prg>
3. Tamil Books on Line – books.tamilcube.com

Course Outcomes (PO)	Programme Specific Outcomes (PSO)				
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	3
CO-2	2	3	2	1	1
CO-3	3	2	2	2	3
CO-4	1	3	3	2	2
CO-5	3	1	2	2	3
Ave	2.4	2.1	2.3	1.8	2.4

Maping	**<40%**	**≥ 40%and<70%**	**≥70%**
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER – I			
Part I French	**Foundation Course: Paper I – French – I**		
Course Code: 23ULFA11/ 23ULFB11	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Learning Objectives:

- Identify the basic French sentence structure
- Comprehend various grammatical tenses and use them to communicate in French
- Review various documents and discuss them to understand the vocabulary
- Analyze and interpret expressions used to convey the cause, the effect, the purpose, and the opposition in French
- Perceive the French culture and system.

Course Outcomes		
Course Outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO-1	Remember the usage of grammatical tenses in constructing sentences.	K1
CO-2	Apply the grammar rules and vocabulary to produce grammatically correct sentences.	K2
CO-3	Appreciate the French culture and civilization.	K3
CO-4	Demonstrate knowledge of various expressions used to express opinions, emotions, cause, effect, purpose, and hypothesis in French	K4
CO-5	Evaluate and summarize with thorough understanding the given texts.	K5

SEMESTER – I			
Part I French	**Foundation Course: Paper I – French - I**		
Course Code: 23ULFA11/ 23ULFB11	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Unit I – Salut, Enchante

1.1 - Saluer
1.2 - Se présenter
1.3 - Présenter quelqu'un
1.4 - En France et ailleurs
1.5 - L'Europe

Unit II – J'adore

2.1 - Exprimer ses gouts
2.2 - Echanger sur ses projets
2.3 - Compléter une fiche d'inscription
2.4 - Remplir un chèque bancaire
2.5 - La famille en France

Unit III – Tu veux bien ?

3.1 - Demander à quelqu'un poliment
3.2 - Parler des actions passées
3.3 - Comprendre le récit d'actions passées
3.4 - Ecrire un message électronique
3.5 - Animaux et compagnie

Unit IV – On se voit quand ?

4.1 - Proposer, accepter ou refuser une invitation
4.2 - Indiquer l'heure et la date
4.3 - Fixer un rendez-vous
4.4 - Comprendre les informations de cartons d'invitation
4.5 - Les français cultivent leur temps libre

Unit V – Bonne idée !

5.1 - Exprimer son point de vue
5.2 - S'informer sur le prix et la quantité
5.3 - Faire des achats dans un magasin
5.4 - Comprendre des offres des cadeaux
5.5 - Quel cadeau offrir ?

Textbook: Régine Mérieux & Yves Loiseau, *Latitudes* -1- (A1 /A2), méthode de français, Didier, 2017 (units 1 - 6 only)

Books, Journals and Learning Resources

- J.Girardet & J.Pécheur avec la collaboration de C.Gibble, Echo A1, CLE international, Paris, 2012.
- Carlo Catherine, Causa Mariella, Civilisation Progressive du Français – I, Paris : CLE International, 2003.
- Dintilhac Anneline, De Oliveira Anouchka, Ripaud Delphine, Dupleix Dorothée, Cocton Marie-Noëlle, *Saison 1 Niveau 1, Méthode de français et cahier d'exercices*, Paris : Didier, 2015

Web Resources:

https://www.lawlessfrench.com/faq/lessons-by-level/

https://bonjourdefrance.com/
www.francaisfacile.com/exercices /

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	2	1	1	3	3	2	1	1
CO-2	2	3	2	1	1	3	3	2	1	1
CO-3	2	2	1	3	3	1	2	3	3	3
CO-4	3	3	1	3	2	2	3	3	2	3
CO-5	3	2	1	1	2	2	2	2	2	2
Ave.	2.6	2.4	1.4	1.8	1.8	2.2	2.6	2.4	1.8	2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER-I			
Part II English	**Poetry, Prose, Extensive Reading and Communicative English-I**		
Course Code: 23UGEN11	**Hrs/Week: 6**	**Hrs/Semester:90**	**Credits:3**

Learning Objectives:

- To enable learners to acquire self-awareness and positive thinking required in various life situations.
- To help them acquire the attribute of empathy
- To assist them in acquiring creative and critical thinking abilities
- To enable them to learn the basic grammar
- To assist them in developing LSRW skills

Course Outcomes			
Course Outcomes	**Upon completion of the course, the students will be able to**	**PSOs Addressed**	**K Level**
CO 1	acquire self-awareness and positive thinking required in various life situations	1,2,3	1
CO 2	acquire the attribute of empathy.	2,3,5	2
CO 3	acquire creative and critical thinking abilities.	2,3,4	3
CO 4	learn basic grammar	4,5	4
CO 5	development and integrate the use of four language skills i.e., listening, speaking, reading and writing.	2,3,4,5	5

SEMESTER- I			
Part II English	**Poetry, Prose, Extensive Reading and Communicative English –I**		
Course Code: 23UGEN11	**Hrs/Week: 6**	**Hrs/Semester:90**	**Credits:3**

I SELF-AWARENESS(WHO) & POSITIVE THINKING(UNICEF)

Life Story

1.1 MalalaYousafzai - Chapter 1 from I am Malala

1.2 M.K.Gandhi - An Autobiography or The Story of My Experiments with Truth (Chapters 1, 2 & 3)

Poem

1.3 Rabindranath Tagore - Where the Mind is Without Fear – Gitanjali 35

1.4 Chinua Achebe - Love Cycle

II EMPATHY

Poem

2.1 David Roth - Nine Gold Medals

2.2 William Wordsworth - Alice Fell or poverty

2.3 E.V. Lucas - The School for Sympathy

2.4 William Faulkner - Barn Burning

III CRITICAL & CREATIVE THINKING

Poem

3.1 Edgar Guest - The Things That Haven't Been Done Before

3.2 Robert Frost - Stopping by the Woods on a Snowy Evening

Readers Theatre

3.3 A Tale of China - The Magic Brocade

3.4 Aaron Shepard - Stories on Stage – (Three Sideway Stories from Wayside School" by Louis Sachar)

IV Part of Speech

4.1 Articles

4.2 Noun

4.3 Pronoun

4.4 Verb

4.5 Adverb

4.6 Adjective

4.7 Preposition

V Paragraph and Essay Writing

5.1 Descriptive

5.2 Expository

5.3 Persuasive

5.4 Narrative Reading Comprehension

Textbook:

Units I-III, V – To be compiled by the PG and Research Department of English

Unit – IV - Joseph, K.V. *A Textbook of English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited, 2006.

Reference Books:

Martin Hewings. *Advanced English Grammar*. Cambridge University Press, 2000.

Web Resources:

1. MalalaYousafzai. I am Malala (Chapter 1) https://archive.org/details/i-am-malala
2. M.K Gandhi. An Autobiography or The Story of My Experiments with Truth(Chapter-1)- Rupa Publication, 2011 https://www.indiastudychannel.com/resources/146521Book-Review-An-Autobiography-or-The-story-of-my-experiments-withTruth.aspx
3. Rabindranath Tagore. "Gitanjali 35" from Gitanjali (Song Offerings)https://www.poetryfoundation.org/poems/45668/gitanjali-35
4. Aaron Shepard.Stories on Stage, Shepard Publications, 2017 https://amzn.eu/d/9rVzlNv
5. J C Nesfield. Manual of English Grammar and Composition. https://archive.org/details/in.ernet.dli.2015.44179

PSO Relation Matrix

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	2	3	2	3	2	3	3	3	3	3
CO-3	3	3	3	2	3	3	3	3	3	3
CO-4	3	3	2	3	3	3	3	2	3	2
CO-5	3	3	3	2	3	3	3	2	2	3
Ave.	2.8	3	2.6	2.6	2.8	3	3	2.6	2.8	2.8

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER I			
Part III	**Core I General Chemistry I**		
Code : 23UCHC11	**Hrs./Week:5**	**Hrs/ Sem: 75**	**Credits:5**

Objectives

The course aims at giving an overall view of the

- Various atomic models and atomic structure
- Wave particle duality of matter
- Periodic table, periodicity in properties and its application in explaining the chemical behaviour
- Nature of chemical bonding, and
- Fundamental concepts of organic chemistry

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**Cognitive Level**
CO-1	explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.	K1
CO-2	classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents	K2
CO-3	apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δ_x, Δ_p electronegativity, percentage ionic character and bond order.	K3
CO-4	evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects	K4
CO-5	construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.	K5

UNIT I Atomic structure and Periodic trends

History of atom (J. J. Thomson, Rutherford)-Moseley's Experiment and Atomic number- Atomic Spectra-Black-Body Radiation and Planck's quantum theory Bohr's model of atom- Franck-Hertz Experiment-Interpretation of H spectrum-Photoelectric effect-Compton effect- Dual nature of Matter- De Broglie wavelength-Davisson and Germer experiment- Heisenberg's Uncertainty Principle-Electronic Configuration of Atoms and ions- Hund's rule-Pauli' exclusion principle - Aufbau principle- Numerical problems involving the core concepts.

Unit II Introduction to Quantum mechanics

Classical mechanics-Wave mechanical model of atom- distinction between a Bohr orbit and orbital; Postulates of quantum mechanics- probability interpretation of wave functions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2.

Modern Periodic Table

Cause of periodicity-Features of the periodic table-classification of elements Periodic trends for atomic size-Atomic radii, Ionic, crystal and Covalent radii- ionization energy- electron affinity- electronegativity-electronegativity scales- applications of electronegativity.

Problems involving the core concepts

UNIT-III Structure and bonding - I

Ionic bond -Lewis dot structure of ionic compounds-properties of ionic compounds-Energy involved in ionic compounds- Born Haber cycle – lattice energies- Madelung constant- relative effect of lattice energy and solvation energy- Ion polarisation – polarising power and polarizability- Fajans' rules - effects of polarisation on properties of compounds- problems involving the core concepts.

Covalent bond -Shapes of orbitals- overlap of orbitals – σ and Π bonds- directed valency hybridization- VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7

Partial ionic character of covalent bond-dipole moment- application to molecules of the type A_2, AB, AB_2, AB_3, AB_4; percentage ionic character- numerical problems based on calculation of percentage ionic character.

UNIT-IV Structure and bonding - II

VB theory – application to hydrogen molecule- concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, CO_3^{2-}, NO_3^- -limitations of VBT- MO theory - bonding, antibonding and nonbonding orbitals- bond order- MO diagrams of H_2, C_2, O_2, O_2^+, O^{2-}, $O_2^{2-}N_2$, NO, HF, CO- magnetic characteristics, comparison of VB and MO theories.

Coordinate bond-Definition- Formation of $BF_3 \rightarrow NH_3$, NH_4^+, H_3O^+ properties

Metallic bond-electron sea model-VB model- Band theory-mechanism of conduction in solids- conductors, insulator, semiconductor – types, applications of semiconductors

Weak Chemical Forces - Vander Waals forces, ion-dipole forces-dipole-dipole interactions- induced dipole interactions-Instantaneous dipole-induced dipole interactions-Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points.

UNIT-V Basic concepts in Organic Chemistry and Electronic effects

Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals- reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes.

Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects.

Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene- bond lengths- steric inhibition to resonance.

Hyperconjugation - stability of alkenes- bond length- orienting effect of methyl group- dipole moment of aldehydes and nitromethane

Types of organic reactions- addition, substitution, elimination and rearrangements

Recommended Text

1. Madan, R. D. and Sathya Prakash, Modern Inorganic Chemistry, 2nd ed.; S. Chand and Company: New Delhi, 2003.
2. Rao, C.N. R. University General Chemistry, Macmillan Publication: New Delhi, 2000.
3. Puri, B. R. and Sharma, L. R. Principles of Physical Chemistry, 38th ed.; Vishal Publishing Company: Jalandhar, 2002.
4. Bruce P.Y. and Prasad K. J. R. Essential Organic Chemistry, Pearson Education: New Delhi, 2008.
5. Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi,2016
6. B. R. Puri, L. R. Sharma and K. C. Kalia Inorganic Chemistry, Milesstone Publisher and Distributor

Reference Books

1. Maron, S. H. and Prutton C. P. Principles of Physical Chemistry,4th ed.; The Macmillan Company: Newyork, 1972.
2. Lee, J. D. Concise Inorganic Chemistry, 4th ed.; ELBS William Heinemann: London, 1991.
3. Gurudeep Raj, Advanced Inorganic Chemistry, 26th ed.; Goel Publishing House: Meerut, 2001.
4. Atkins, P.W. & Paula, J. Physical Chemistry, 10th ed.; Oxford University Press:New York, 2014.
5. Huheey, J. E. Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed: Addison, Wesley Publishing Company: India, 1993.

Website and e-learning source

1) https://onlinecourses.nptel.ac.in
2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm
3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html
4) https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding
5) https://www.chemtube3d.com/

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	1	2	2	1	3	2	3	2	3
CO-2	1	3	2	2	3	2	3	2	2	3
CO-3	3	2	1	2	2	3	2	2	2	3
CO-4	3	3	2	2	2	1	3	3	2	3
CO-5	1	1	3	2	2	3	1	2	2	3
Ave.	2.2	2	2	2.0	2.0	2.4	2.1	2.3	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER I			
Part III Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations			
Code :23UCHCR1	**Hrs./Week: 3**	**Hrs/ Sem: 45**	**Credits:3**

Objectives

This course aims at providing knowledge on

- Laboratory safety
- Handling glasswares
- Quantitative estimation
- Preparation of inorganic compounds

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	explain the basic principles involved in titrimetric analysis and inorganic preparations.	K1
CO-2	compare the methodologies of different titrimetric analysis.	K2
CO-3	calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.	K3
CO-4	assess the yield of different inorganic preparations and identify the end point of various titrations.	K4
CO-5	estimate the concentration of given solution.	K5

Unit I Chemical Laboratory Safety in Academic Institutions

Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.

Common Apparatus Used in Quantitative Estimation (Volumetric)

Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.

Principle of Quantitative Estimation (Volumetric)

Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.

Unit II Quantitative Estimation (Volumetric)

Preparation of standard solution, dilution from stock solution

Permanganometry

Estimation of sodium oxalate using standard ferrous ammonium sulphate

Dichrometry

Estimation of ferric alum using standard dichromate (external indicator)

Estimation of ferric alum using standard dichromate (internal indicator)

Iodometry

Estimation of copper in copper sulphate using standard dichromate

Argentimetry

Estimation of chloride in barium chloride using standard sodium chloride/ Estimation of chloride in sodium chloride (Volhard's method)

Unit III Complexometry

Estimation of Zinc

Estimation of hardness of water using EDTA

Estimations

Estimation of iron in iron tablets

Estimation of ascorbic acid.

Preparation of Inorganic compounds

Potash alum

Tetraammine Copper (II) Sulphate

Hexammine Cobalt (III) Chloride

Mohr's Salt

Recommended Text

1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. Basic Principles of Practical Chemistry,2nd ed.; Sultan Chand &Sons: New Delhi, 1997.
2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; An advanced course in Practical Chemistry, 3rd ed.; New Central Book Agency: Kolkata, 2007.

Reference Books

1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; Vogel's Textbook of Quantitative Chemical Analysis, 6th ed.; Pearson Education Ltd: New Delhi, 2000.

Web References:

1) http://www.federica.unina.it/agraria/analytical-chemistry/volumetricanalysis

2) https://chemdictionary.org/titration-indicator

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Semester I			
GENERIC ELECTIVE I - FUNDAMENTALS OF BOTANY I			
Course Code: 23UBOE11	**Hrs/ Week: 4**	**Hrs/ Semester: 60**	**Credits: 4**

OBJECTIVES

1. To study morphological and anatomical adaptations of plants of various habitats.
2. To provide comparative analysis of major groups of microbes.
3. To familiarize with the cell organelles and division.
4. To demonstrate techniques of plant tissue culture.
5. To understand the laws of inheritance, genetic basis of loci and allele.

COURSE OUTCOMES

CO	On completion of this course, the students will be able to	PO
CO1	recall the general characteristics of algae, fungi, bacteria, virus, bryophytes, pteridophytes, gymnosperms, concept of cell and Mendel's experiment	**K1**
CO2	distinguish between diverse groups of algae, fungi, bacteria, virus, bryophytes, pteridophytes and gymnosperms using their characteristic features, compare mitotic and meiotic division and explain *in vitro* culture methods in plant tissue culture	**K2**
CO3	demonstrate practical skills in thallophytes, microbes, bryophytes, pteridophytes, gymnosperms, cell biology and plant biotechnology	**K3**
CO4	compile the structure, reproduction and life cycle of algae, microbes, bryophytes, pteridophytes and gymnosperms, compare the structure and function of cells and explain the development of cells, analyze the genetics problems and tissue culture techniques	**K4**
CO5	evaluate the economic and ecological significance of different groups of plants	**K5**

Semester I			
GENERIC ELECTIVE I - FUNDAMENTALS OF BOTANY I			
Course Code: 23UBOE11	**Hrs/ Week: 4**	**Hrs/ Semester: 60**	**Credits: 4**

UNIT I **Algae:**

General characters of algae - Structure, reproduction and life cycle of the following genera - *Anabaena* and *Sargassum* and economic importance of algae.

UNIT II **Fungi, Bacteria and Virus:**

General characters of fungi, structure, reproduction and life cycle of the following genera - *Penicillium* and *Agaricus* and economic importance of fungi.Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria. Virus - general characters, structure of TMV,structure of bacteriophage.

UNIT III **Bryophytes, Pteridophytes and Gymnosperms:**

General characters of Bryophytes, Structure and life cycle of *Funaria*. General characters of Pteridophytes, Structure and life cycle of *Lycopodium*. General characters of Gymnosperms, Structure and life cycle of *Cycas*.

UNIT IV **Cell Biology:**

Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultrastructure and function of chloroplast, mitochondria and nucleus. Cell division -mitosis and meiosis.

UNIT V **Genetics and Plant Biotechnology:**

Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods. Plant tissue culture and its application in biotechnology.

Recommended Texts

1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S. Viswanathan Pvt. Ltd., Madras.

Reference books

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - SurjeetPublications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand and Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand and Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes Surjeet Publications, Delhi.
7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol. I and II, S.Chand and Co. New Delhi.

Web Resources

1. https://www.kobo.com/us/en/ebook/the-algae-world
2. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF- 15P).html
3. http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm
4. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
5. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond- pine-cones-an-introduction-to-gymnosperms.pdf
6. https://www.us.elsevierhealth.com/medicine/cell-biology
7. https://www.us.elsevierhealth.com/medicine/genetics
8. https://www.kobo.com/us/en/ebook/plant-biotechnology-1

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	3	3	3	3	2
CO2	3	2	3	3	3	3	3	3	3	3
CO3	3	3	3	2	1	3	3	3	3	3
CO4	3	3	2	3	3	3	3	2	3	3
CO5	3	1	3	3	3	3	3	3	2	3
Avg	3	2.2	2.8	2.8	2.4	3	3	2.8	2.8	2.8

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Semester I			
GENERIC ELECTIVE PRACTICAL I- FUNDAMENTALS OF BOTANY I PRACTICAL I			
Course CODE: 23UBOER1	**Hrs/Week: 2**	**Hrs/Semester: 30**	**Credits: 1**

OBJECTIVES

1. To enhance information on the identification of each taxonomical group by developing the skill - based detection of the morphology and micro structure of microorganisms.
2. To comprehend the fundamental concepts and methods used to identify algae, fungi, Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
3. To study the cell organelles and functions
4. To perform genetic problems.
5. To carry out experiments related with plant Biotechnology.

COURSE OUTCOMES

CO	**On completion of this course, the students will be able to**	**PO**
CO1	identify the morphological and internal organization of algae and fungi, bryophytes, pteridophytes and gymnosperms.	**K1**
CO2	understand the fundamental concepts of plant groups, their evolutionary and reproductive mechanisms, and the laws of inheritance.	**K2**
CO3	solve the genetic problems to understand the concepts of Mendelian theories.	**K3**
CO4	distinguish the structures and functions of various cell organelles, as well as different methods of tissue culture techniques	**K4**
CO5	evaluate the significance of different plant groups in tissue culture and recommend biotechnological methods for a sustainable environment	**K5**

Semester I			
GENERIC ELECTIVE PRACTICAL I- FUNDAMENTALS OF BOTANY I PRACTICAL I			
Course Code: 23UBOER1	**Hrs/Week: 2**	**Hrs/Semester: 30**	**Credits: 1**

EXPERIMENTS

1. Make suitable micropreparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.

   Algae: *Sargassum* - T.s of axis, T.s of leaf

   Fungi: *Agaricus* – T.s of pileus

   Bryophytes: *Funaria* - T.s of stem and leaf

   Pteridophytes: *Lycopodium* – T.s of stem and L.s of cone

   Gymnosperms: *Cycas* – T.s of leaf
2. Electron micrograph of chloroplast, mitochondria and nucleus
3. Preparation of onion root tip using squash technique and identification of different stages of mitosis
4. To work out simple genetic problems in monohybrid and dihybrid
5. Spotters- Algae, bacteria, virus, Fungi, Bryophytes, Pteridophytes and Gymnosperms
6. Preparation of tissue culture media and demonstrate anther and embryo culture
7. Submission of Record note book

Recommended Texts

1. Bendre Kumar, 2014, A Text book of Practical Botany, volume I and II (7^{th} Edition) Rastogi publications, Meerut.
2. Sharma, O.P. 2017.Bryophyta, Mac Millan India Ltd, New Delhi.
3. Sharma, O.P.2012. Pteridophyta, TataMc Graw-Hills Ltd, New Delhi.
4. Benjamin, A. Pierce. 2012. Genetics - Aconceptual Approach. Freeman and Company, New York, England.

Reference Books

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.

3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.

Web Sources

1. https://www.amazon.in/Practical-Manual-PteridophytaRajan-Sundara/dp/8126106883
2. https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover
3. https://medlineplus.gov/genetocs/understanding/basics/cell/
4. https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4
5. http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf

MAPPING WITH PROGRAMME OUTCOMES:

S-

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO 5
CO1	3	2	3	2	3	3	3	3	3	3
CO2	3	3	3	2	1	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	1	2
CO4	3	2	3	2	2	3	3	2	3	3
CO5	3	3	3	2	3	3	3	3	3	3
Avg	3	2.6	3	2.2	2	3	3	2.8	2.6	2.8

Strong (3) **M-Medium (2)** **L-Low(1)**

SEMESTER – I			
Part III Generic Elective I - Mathematics – I			
Code : 23UMAE11	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits: 5**

Objectives:

- To help physical science students to achieve their goals and to develop their mathematical skills.
- To help students to appreciate the uses of derivatives and integrals in day today life and solve real life problems

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	recall and demonstrate the fundamental concepts in the theory of equations, including the formation of equations, the relation between roots and coefficients, and the manipulation of reciprocal equations.	K1
CO-2	understand the transformation of equations, methods for obtaining approximate solutions (such as Newton's method and Homer's method), and the principles underlying these techniques.	K2
CO-3	apply matrix algebra concepts, including the formation of characteristic equations, determination of eigenvalues and eigenvectors, and application of Cayley Hamilton theorem to solve simple problems.	K3
CO-4	analyze differential equations of first order with higher degrees, understand solvable equations for various variables (p, x, y), and recognizing and solving partial differential equations in their four standard forms.	K4
CO-5	create solutions using Laplace transformation, demonstrate an understanding of the process and apply the inverse Laplace transformation to revert transformed equations back to their original forms.	K5

SEMESTER – I			
Part III Generic Elective I - Mathematics - I			
Code : 23UMAE11	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits: 5**

Unit I

Theory of equations - Formation of equations - Relation between roots and coefficients-Reciprocal equations.

Unit II

Transformation of equations -Approximate solutions to equations-Newton's method and Homer's method

Unit III

Matrices-Characteristic equation of a matrix-Eigen values and Eigen vectors-Cayley Hamilton theorem and simple Problems.

Unit IV

Differential equation of first order but of higher degree - Equations solvable for p,x,y-Partial differential equations – Formations – Four Standard forms.

Unit V

Laplace transformation-Inverse Laplace transformation.

Text Book

1. S. Arumugam & Issac, Allied Mathematics, New Gamma Publishing House (2012), Palayamkottai.

Reference Books

1. Narayanan S., Kandaswamy P., Hanumantha Rao R., Manicavachagom Pillay T.K., **Ancillary Mathematics Vol. - I**, S.Viswanathan (Printers & Publishers), Pvt., Ltd., 2010
2. Narayanan S., Kandaswamy P., Hanumantha Rao R., Manicavachagom Pillay T.K., **Ancillary Mathematics Vol. - II**, S.Viswanathan (Printers & Publishers), Pvt., Ltd., 2010.

Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	1	2	2	1	2	3	2	2
CO-2	2	2	2	2	3	2	3	2	2	3
CO-3	3	2	2	2	2	2	2	2	2	3
CO-4	3	3	2	2	2	2	3	3	2	2
CO-5	2	2	2	2	2	2	2	2	2	3
Ave.	2.6	2.2	1.8	2.0	2.2	1.8	2.4	2.4	2	2.6

SEMESTER I			
Part IV	**SEC I**	**Role of Chemistry In Daily Life**	
23UCHSE1	**Hrs./Week:2**	**Hrs/Sem: 30**	**Credits:2**

Objectives

This course aims at providing an overall view of the

- Importance of Chemistry in everyday life
- Chemistry of building materials and food
- Chemistry of Drugs and pharmaceuticals

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**Cognitive Level**
CO-1	learn about the chemicals used in everyday life, building materials, food constituents, fertilizers and pharmaceutical drugs.	K1
CO-2	get knowledge on air pollution, water pollution, plastics, cosmetics, Cement, ceramics, glass and polythene, PVC, Bakelite, polyesters, explosives, and role of chemicals in food production.	K2
CO-3	acquire information about pollutants, Food and Nutrition, cosmetics fuels and pigments and explosives.	K3
CO-4	discuss about the components that pollute air and water, building materials, physiological importance of nutrients, chemicals in food production, colour chemicals and drugs.	K4
CO-5	have an idea about the general survey of chemicals in everyday life, engineering materials, and general formulation of cosmetics, Pigments drugs and explosives.	K5

UNIT I Environmental Chemistry

General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water-qualities of potable water-soft and hard water, methods of removal of hardness-water pollution

UNIT II Chemistry of building materials and Plastics

Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics – polythene-PVC-Bakelite-polyesters-melamine-formaldehyde resins -preparation and uses only.

UNIT III Food, Nutrition and Cosmetics

Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins (sources and their physiological importance). Cosmetics – tooth paste-face powder-soaps and detergents-shampoos-nail polish-perfumes - general formulation and preparations - possible hazards of cosmetic use.

UNIT IV Chemicals in Food Production and Fuels

Chemicals in food production – fertilizers - need –types-natural sources- characteristics and importance of manures-urea-NPK fertilizers-super phosphate-triple super phosphate. Fuel – classification - solid, liquid and gaseous -nuclear fuel examples and uses.

UNIT V Chemistry of Drugs, Colour and Explosives

Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin.

Colour chemicals – pigments-functions- characteristics-examples and applications.

Dyes - classification and examples

Explosives - classification and examples.

Recommended Text

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012.
3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
4. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
5. Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019.

6. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co. Publishers, second edition, 2006.

Reference Books

1. Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourth edition, 1977.
2. W.A. Poucher, Joseph A. Brink, Jr. Perfumes, Cosmetics and Soaps, Springer, 2000.
3. A.K. De, Environmental Chemistry, New Age International Public Co., 1990.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	3	3	1	3	2	3	3	3
CO-2	3	2	3	3	2	3	3	3	2	3
CO-3	3	2	3	3	2	3	2	3	2	3
CO-4	3	2	3	3	2	2	3	3	2	3
CO-5	3	1	3	2	2	3	1	3	3	3
Ave.	2.2	1.6	3.0	2.8	1.8	3	2.2	3	2.4	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER I			
Part IV **FC** **Fundamental Concepts in Chemistry**			
23UCHF11	**Hrs./Week:2**	**Hrs/ Sem: 30**	**Credits:2**

Objectives

This course aims at providing an overall view of the

- Fundamental concepts in chemistry
- Chemistry of organic chemistry
- Basics of spectroscopy.

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**Cognitive Level**
CO-1	learn about the basic concepts in chemistry, chemical bonding, isomerism, states of matter and spectroscopy.	K1
CO-2	understand the periodic properties, bonding involved in the hybridization, nomenclature of organic compounds, properties of gas, liquids and solids and the principles of spectroscopy.	K2
CO-3	discuss about the classification of elements, magnetic properties, isomerism involved in organic compounds, types of solids, quantization of energy level.	K3
CO-4	explain quantum number, coordination compounds, IUPAC Nomenclature, states of matter and its unique features, electromagnetic radiation.	K4
CO-5	assess the rules governing electronic configuration, concept of hybridization, behavior of various states of matter, classification of hydrocarbons, application of spectroscopic applications in various fields.	K5

UNIT I Structure of atom and periodic classification of Elements and properties

Atom structure-Fundamental particles - Atomic mass - Atomic number – Isotopes –Isobars – Isotones – Orbitals - Quantum number and their significance. Shapes of s, p and d orbitals -Rules governing electronic configuration in various atomic orbitals. Periodic table-periodic laws (Mendeleev and Mosley) - Classification of elements into s, p, d and f-blocks. Metals - Non metals - Periodic properties – Concept and Variation along the group and period.

UNIT II Chemical bonding

Definition- Types of chemical bond- Ionic bond- Ion polarization - Dipole moment and Percentage of ionic character - Covalent bond-Definition – Postulates of Valence bond theory and Concept of hybridization (sp, sp^2 ,sp^3 , sp3d, sp3d 2 , dsp2 , d2 sp3) – Magnetic properties – Paramagnetic – Diamagnetic - Ferromagnetic. Co-ordinate covalent bond-Definition – Examples - Co-ordination compounds (basic concepts only).

UNIT III Nomenclature and Isomerism in organic compounds

Carbon compounds - Classification of hydrocarbons - IUPAC Nomenclature of Organic compounds. Isomerism: Structural and Stereoisomerism-Structural Isomerism: Chain isomerism-Functional isomerism-Positional isomerism- Meta isomerism. Stereoisomerism: Geometrical and Optical isomerism.

UNIT IV States of Matter

Gaseous state: Kinetic theory of gases - Ideal and Non-ideal gases - Ideal gas equation Deviation of ideal gas from ideal behavior –van der Waal's equation and Liquefaction of gases. Liquids: Intermolecular forces, Vapour pressure and Boiling point of liquid - Surface tension –Viscosity - Factors affecting surface tension and viscosity- Solids -Definition - Characteristics of solids - Amorphous and Crystalline solids.

UNIT V Introduction to Spectroscopy

Electromagnetic radiation - General characteristics of Wave – Wavelength – Frequency – Amplitude – Wave number - Electromagentic spectrum- Absorption and Emission spectrum -Quantization of Energy level - Types of spectroscopy-Microwave spectroscopy-Infrared spectroscopy-UV-Visible spectroscopyNuclear Magnetic Resonance spectroscopy-Electron spin resonance spectroscopy. (Principle and applications).

Recommended Text

1. P. L. Soni, H. M. Chawla, Text Book of Inorganic Chemistry;Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
2. Madan, R. D. and Sathya Prakash, Modern Inorganic Chemistry, 2nd ed.; S. Chand and Company: New Delhi, 2003.
3. Rao, C.N. R. University General Chemistry, Macmillan Publication: New Delhi, 2000.
4. Bruce, P. Y. and Prasad K. J. R. Essential Organic Chemistry, Pearson Education: New Delhi, 2008.
5. R. Puri, L. R. Sharma, M. S. Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.

Reference Books

1. Gurudeep Raj, Advanced Inorganic Chemistry, 26th ed.; Goel Publishing House: Meerut, 2001.
2. Atkins, P.W. & Paula, J. Physical Chemistry, 10th ed.; Oxford University Press: New York, 2014.
3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S. Chand and Company, New Delhi.

E-learning Source:

https://onlinecourses.nptel.ac.in

http://cactus.dixie.edu/smblack/chem1010/lec

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	1	2	1	3	2	3	2	1
CO-2	1	3	2	2	2	2	3	2	1	1
CO-3	3	1	1	2	2	3	2	3	2	3
CO-4	3	3	2	2	2	1	3	3	2	2
CO-5	1	1	3	2	1	3	1	2	2	3
Ave.	2.2	1.8	1.8	2.0	1.6	2.4	2.1	2.3	1.8	2.0

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER - II			
Part -1 Tamil பொதுத்தமிழ் - தாள் 2 - சமய இலக்கியங்கள் செய்யுள், இலக்கணம், இலக்கிய வரலாறு			
Code :23ULTA21	**Hrs/Week:6**	**Hrs/ Semester : 90**	**Credits :4**

நோக்கங்கள்

	கற்றல் நோக்கங்கள்
1	இறை ஆற்றலை உணர்ந்துகொள்ள உதவுகிறது
2	தமிழ் மொழியைப் பிழையின்றி எழுதவும் பேசவும் முடியும்.
3	அன்பு, இரக்கம், நற்சொல், நற்செயல் போன்ற நற்பண்புகளோடு வாழ வழி வகுக்கிறது.
4	இலக்கிய வரலாற்றின் வழி மொழியின் வளர்ச்சியையும் காலந்தோறும் மாறிவரும் இலக்கியங்களின் பல்வேறு வகைகளையும் தெரிந்து கொள்வர். துறைதோறும் தமிழ் மொழியின் வளர்ச்சியை அறிவர்.
5	தன்னம்பிக்கை உருவாக்கி, வேலை வாய்ப்பிற்கான தேர்வுகளில் திறமையுடன் பங்கேற்பர்.

பாடத்திட்டத்தின் பயன்கள்

CO.NO	இப்பாடத்திட்டம் - மாணவியரிடம்	அறிவாற்றல் திறன்
CO-1	தமிழரின் சமய தத்துவங்களை அறிந்து தெளிவு பெறுவர்	K1
CO-2	பல்வேறு சமய கருத்துகளை அறிவதன் மூலம் சமய ஒற்றுமை உணர்வு பெறுவர்.	K2
CO-3	மொழியறிவோடு சிந்தனைத்திறன் அதிகரித்தல்	K3
CO-4	இறைவன் முன் அனைவரும் சமம் என்ற சிந்தனையை உருவாக்குகிறது.	K4
CO-5	தனிமனித, சமுதாய வாழ்க்கைச் சிக்கல்களை எதிர்கொள்ளும் நிலையை உருவாக்குகிறது.	K5

அலகு – 1 **(18 மணி நேரம்)**

பக்தி இலக்கியம்

1. திருநாவுக்கரசர் தேவாரம் - நாமார்க்கும் குடியல்லோம் எனத் தொடங்கும் வரிகள் - 10 பாடல்கள்
2. ஆண்டாள் - திருப்பாவை (முதல் 10 பாசுரம்)

அலகு – 2 **(18 மணி நேரம்)**

1. வள்ளலார் - அருள் விளக்கமாலை (முதல் 10 பாடல்கள்)
2. எச்.ஏ. கிருட்டிணப்பிள்ளை - இரட்சணிய மனோகரம் - பால்ய பிரார்த்தனை
3. குணங்குடி மஸ்தான் சாகிபு – பராபரக்கண்ணி (முதல் 10 கண்ணிகள்)

அலகு – 3 **(18 மணி நேரம்)**

சிற்றிலக்கியங்கள்

1. தமிழ்விடு தூது - (முதல் 20 கண்ணிகள்)
2. திருக்குற்றாலக் குறவஞ்சி - குறத்தி மலைவளம் கூறுதல்
3. முக்கூடற்பள்ளு - நாட்டு வளம்

அலகு – 4 **(18 மணி நேரம்)**

இலக்கணம்

1. சொல்லின் பொது இலக்கணம்
2. ஒரெழுத்து ஒரு மொழிகள், சொல்லின் வகைகள்
3. பெயர்ச்சொல் - அறுவகைப் பெயர்கள்
4. வினைச் சொல் - இலக்கணம் - வகைகள்
5. இடைச்சொல் - இலக்கணம் - வகைகள்
6. உரிச்சொல் - இலக்கணம் - வகைகள்

அலகு - 5 **(18 மணி நேரம்)**

இலக்கிய வரலாறு

1. பன்னிரு திழுமுறைகள்
2. நாலாயிர திவ்யப் பிரபந்தம்
3. திருமடங்களின் தமிழ்ப்பணி
4. சைவ சித்தாந்த சாத்திரங்கள்

துணைநின்ற நூல்கள்

1. பன்னிரு திருமுறைகள் - பேரா. அ. மாணிக்கம் (உரையாசிரியர்)

வர்த்தமானன் பதிப்பகம்
21, இராமகிருஷ்ணா தெரு
தியாகராய நகர்
சென்னை – 17.

2. திருக்குறள் - பரிமேலழகர் (உரையாசிரியர்)
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

3. நாலடியார் - தி.சு. பாலசுந்தரம் பிள்ளை

திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

பார்வை நூல்கள்

1. நன்னூல் - பவணந்தி முனிவர்
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

2. தமிழ் இலக்கிய வரலாறு - தமிழ்த்துறை தொகுப்பு
தூய மரியன்னை கல்லூரி (தன்னாட்சி),
தூத்துக்குடி.

3. பதினெண் கீழ்க்கணக்கு நூல்கள் - எம். நாராயண வேலுப்பிள்ளை

நர்மதா பதிப்பகம், தியாகராய நகர், சென்னை.

இணைய ஆதாரங்கள்

1. Project Madurai –www.projectmadurai.org

2. Tamil Universal Digital Library – www.ulib.prg<http://www.ulib.prg>

3. Tamil Books on Line – books.tamilcube.com

Course Outcomes (PO)	Programme Specific Outcomes (PSO)				
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	3
CO-2	2	3	2	1	1
CO-3	3	2	2	2	3
CO-4	1	3	3	2	2
CO-5	3	1	2	2	3
Ave	2.4	2.1	2.3	1.8	2.4

Maping	**<40%**	**≥ 40%and<70%**	**≥70%**
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER - II			
Part I French	**Foundation Course: Paper II – French – II**		
Course Code: 23ULFA21/ 23ULFB21	**Hrs / Week: 6**	**Hrs / Semester : 90**	**Credits:3**

Learning Objectives:

- To revise basic French sentence structure and vocabulary.
- To enumerate the various grammatical tenses and use them to communicate better in French.
- To develop the language proficiency of the learners by practising all for competencies: Reading, writing, listening, and speaking.
- To analyse and interpret verbal expressions of cause, effect, purpose, and opposition in French
- To comprehend text passages and use them to express their opinions.

Course Outcomes		
Course Outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO-1	Identify the purpose of using various tenses and effectively employ them in speaking and writing	K1
CO-2	Summarize a French document such as posters, bulletins, and infographics	K2
CO-3	Discuss the French culture and the differences.	K3
CO-4	Analyse and utilize the grammatical concepts in drafting sentences and paragraphs	K4
CO-5	Demonstrate knowledge of various expressions used to convey opinion, emotions, cause, effect, purpose, and hypothesis in French	K5

SEMESTER - II			
Part I French	**Foundation Course: Paper II – French - II**		
Course Code: 23ULFA21/ 23ULFB21	**Hrs / Week: 6**	**Hrs / Semester : 90**	**Credits:3**

Unit I – C'est où ?

1.1 - Demander et indiquer une direction
1.2 - Localiser
1.3 - Comprendre des indications de direction et de lieu
1.4 - Se repérer sur un plan de ville
1.5 - Architecture et nature

Unit II – N'oubliez pas

2.1 - Exprimer l'obligation ou l'interdit
2.2 - Conseiller
2.3 - Comprendre une chanson
2.4 - Comprendre un récit de vacances
2.5 - La France d'Outre-mer

Unit III - Belle vue sur la mer

3.1 - Décrire un lieu
3.2 - Se situer dans le temps
3.3 - Comprendre la description d'un lieu
3.4 - Comprendre des pictogrammes
3.5 - L'Union européenne

Unit IV – Quel beau voyage, Oh Joli

4.1 - Raconter un souvenir
4.2 - Exprimer l'intensité et la quantité
4.3 - Comparer
4.4 - Francophonie
4.5 - Mode et société

Unit V – Les compétences communicatifs

5.1 - Les lettres formelles
5.2 - Les lettres informelles

Textbook: Régine Mérieux & Yves Loiseau, *Latitudes* -1- (A1 /A2), méthode de français, Didier, 2017 (units 7-11 only)

Books, Journals and Learning Resources

- J.Girardet & J.Pécheur avec la collaboration de C.Gibble, Echo A1, CLE international, Paris, 2012.

- Carlo Catherine, Causa Mariella, Civilisation Progressive du Français – I, Paris : CLE International, 2003.
- Dintilhac Anneline, De Oliveira Anouchka, Ripaud Delphine, Dupleix Dorothée, Cocton Marie-Noëlle, *Saison 1 Niveau 1, Méthode de français et cahier d'exercices*, Paris : Didier, 2015

Web Resources:

https://www.lawlessfrench.com/faq/lessons-by-level/

https://bonjourdefrance.com/

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	2	1	1	3	3	2	1	1
CO-2	2	3	2	1	1	3	3	2	1	1
CO-3	2	2	1	3	3	1	2	3	3	3
CO-4	3	3	1	3	2	2	3	3	2	3
CO-5	3	2	1	1	3	3	3	3	3	3
Ave.	2.6	2.4	1.4	1.8	1.8	2.4	2.8	2.6	2	2.2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER - II			
Part II English	**Poetry, Prose, Extensive Reading, and Communicative English - II**		
Course Code: 23UGEN21	**Hrs / Week: 6**	**Hrs / Semester : 90**	**Credits:3**

Learning Objectives:

- To assist the learners to interpret the literary pieces to identify elements of resilience, determination, decision making skills, and problem-solving skills.
- To aid them to demonstrate improved empathy and understanding for diverse life experiences through literary analysis and discussions.
- To develop the language proficiency of the learners by practising the usage of tenses in various contexts.
- To understand the importance of tone, clarity, and formality in workplace communication.
- To enhance the creative and the critical thinking skills of the learners through class discussions and assignments.

Course Outcomes			
Course Outcomes	**Upon completion of the course, the students will be able to**	**PSOs Addressed**	**K Level**
CO1	learn to talk about everyday activities confidently	1	1
CO2	be able to write short paragraphs on people, places, and events	1, 2	2
CO3	identify the purpose of using various tenses and effectively employ them in speaking and writing	3, 4	3
CO4	gain knowledge to write subjective and objective descriptions	4, 5,	4
CO5	identify and use their skills effectively in formal contexts.	3, 4, 5	5

SEMESTER - II			
Part II English	**Poetry, Prose, Extensive Reading, and Communicative English - II**		
Course Code: 23UGEN21	**Hrs / Week: 6**	**Hrs / Semester : 90**	**Credits:3**

Unit I – Resilience

Poetry

William Ernest Henley : Invictus

Maya Angelou : Still I Rise

Prose

Julian Koepcke : How I Survived a Plane Crash

Unit II – Decision Making Skills

Poetry

Rudyard Kipling : If

Stanley Kunitz : The Layers

Short Story

Frank Stockton : The Lady or the Tiger

Unit III - Problem Solving Skills

Prose- Life Story

Sudha Murthy : How I taught My Grandmother to Read

Autobiography

A. J. Cronin : Two Gentlemen of Verona

A.P.J. Abdul Kalam : Wings of Fire (Chapters 1,2,3)

Unit IV – Language Competency

Tenses

Present Tense

Past Tense

Future Tense

Unit V - English at the Workplace

E-mail – Invitation, Enquiry, Seeking Clarification

Formal Letters

Circular

Minutes of the Meeting

Textbook:

Units I-III, V – To be compiled by the PG and Research Department of English

Unit – IV - Joseph, K.V. *A Textbook of English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited, 2006.

Reference Books:

Martin Hewings. *Advanced English Grammar*. Cambridge University Press, 2000.

Web Resources:

https://www.poetryfoundation.org/

https://www.teachingenglish.org.uk/teaching-resources/teaching-adults/lesson-plans

https://www.perfect-english-grammar.com/support-files/tenses-explanations.pdf

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO- 1	**PO-2**	**PO-3**	**PO- 4**	**PO- 5**	**PSO- 1**	**PSO- 2**	**PSO- 3**	**PSO- 4**	**PSO- 5**
CO-1	3	2	3	3	2	3	2	3	2	2
CO-2	2	3	3	3	3	2	3	2	2	3
CO-3	3	3	3	3	3	3	3	2	2	3
CO-4	2	3	3	3	2	2	3	3	2	2
CO-5	3	3	3	2	2	3	3	3	3	2
Ave.	2.6	2.8	3	2.8	2.4	2.6	2.8	2.6	2.2	2.4

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER II			
Part III	**Core II General Chemistry II**		
Code: 23UCHC21	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 5**

Objectives

This course aims at providing an overall view of the

- Chemistry of acids, bases and ionic equilibrium
- Properties of s and p-block elements
- Chemistry of hydrocarbons
- Applications of acids and bases
- Compounds of main block elements and hydrocarbons

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**Cognitive Level**
CO-1	explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons	K1
CO-2	discuss the periodic properties of sand p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids	K2
CO-3	classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons	K3
CO-4	explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements	K4
CO-5	assess the application of hard and soft acids indicators, buffers, compounds of s and p- block elements and hydrocarbons	K5

UNIT I Acids, bases and Ionic equilibria

Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept-Lewis concept-Relative strengths of acids, bases and dissociation constant-dissociation of poly basic acids, ionic product of water-pH scale-pH of solutions-Degree of dissociation-common ion effect- factors affecting degree of dissociation-acid base indicators-theory of acid base indicators – action of phenolphthalein and methyl orange- titration curves - use of acid base indicators;

Buffer solutions – types- mechanism of buffer action in acid and basic buffer- Henderson-Hasselbalch equation; Salt hydrolysis - salts of weak acids and strong bases- weak bases and strong acids- weak acids and weak bases - hydrolysis constant- degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product - determination and applications; numerical problems involving the core concepts.

Unit II Chemistry of s - Block Elements

Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides- hydroxides- halides- carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation- properties and uses of NaOH- Na_2CO_3- KBr- $KClO_3$ alkaline earth metals. Anomalous behaviour of Be.

Chemistry of p- Block Elements (Group 13 & 14) preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al.

Comparison of carbon with silicon. Carbon-di-sulphide – Preparation- properties- structure and uses. Percarbonates- per monocarbonates and per dicarbonates.

UNIT III Chemistry of p- Block Elements (Group 15-18)

General characteristics of elements of Group 15; chemistry of H_2N-$NH_2$and HNO_3. Chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4).

General properties of elements of group16 - Structure and allotropy of elements - chemistry of ozone (MO diagram not needed) - Classification and properties of oxides - oxides of Sulphur (SO_2 and SO_3) – peroxo acids of sulphur (Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity- electron affinity- oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI) and oxy acids ($HClO_4$). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens [$(CN)_2$ and $(SCN)_2$] and basic nature of Iodine.

Noble gases: Position in the periodic table. Preparation- properties and structure of XeF_2, XeF_4, XeF_6 and $XeOF_4$; uses of noble gases - clathrate compounds.

UNIT IV Hydrocarbon Chemistry-I

Petroproducts: Fractional distillation of petroleum; cracking- isomerisation- alkylation- reforming and uses

Alkenes-Nomenclature- general methods of preparation – Mechanism of elimination reactions – E_1 and E_2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule- Kharasch effect- oxidation reactions – hydroxylation- oxidative degradation- epoxidation- ozonolysis; polymerization.

Alkadienes- Nomenclature - classification – isolated- conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels–Alder reactions – polymerisation – polybutadiene- polyisoprene (natural rubber)- vulcanisation- polychloroprene.

Alkynes Nomenclature; general methods of preparation- properties and reactions; acidic nature of terminal alkynes and acetylene- polymerisation and isomerisation.

Cycloalkanes: Nomenclature- Relative stability of cycloalkanes- Bayer's strain theory and its limitations. Conformational analysis of cyclohexane- mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes.

UNIT V Hydrocarbon Chemistry - II

Aromaticity- Huckel's (4n+2) rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration- sulphonation- halogenation- Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity.

Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature- Haworth synthesis; physical properties- reactions – electrophilic substitution reaction- nitration- sulphonation- halogenation- Friedel – Crafts acylation & alkylation- preferential substitution at α - position – reduction- oxidation – uses.

Anthracene – synthesis by Elbs reaction- Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction- preferential substitution at C-9 and C-10; uses.

Recommended Text

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded, S.Chand and Company, New Delhi.
2. Sathya Prakash, Tuli G D,Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi.
3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi.
4. Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi.
5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar.

6. P.L.Soni, Textbook of Inorganic Chemistry (2006) Sultan Chand and Sons can be included as recommended text book.

Reference Books

1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, Newyork.
2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi.
3. Lee J D, (1991), Concise Inorganic Chemistry, 4thed., ELBS William Heinemann, London.
4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India.
5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed., Goel Publishing House, Meerut.
6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8thed.,Goel Publishing House, Meerut.

Website and e-learning source

1. https://onlinecourses.nptel.ac.in
2. http://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html
3. http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding
4. MOOC components
   http://nptel.ac.in/courses/104101090/
5. Lecture 1: Classification of elements and periodic properties
   http://nptel.ac.in/courses/104101090/

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	2	2	2	3	3	3	2	1
CO-2	3	3	2	2	3	2	3	2	2	3
CO-3	3	2	1	2	3	3	2	2	2	2
CO-4	3	3	2	2	2	1	3	3	2	3
CO-5	1	2	3	2	2	3	1	2	2	1
Ave.	2.6	2.4	2	2.0	2.4	2.4	2.4	2.3	2	2

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER II			
Part III Qualitative Organic Analysis And Preparation Of Organic Compounds			
Code : 23UCHCR2	**Hrs/Week:3**	**Hrs/ Sem: 45**	**Credits:3**

Objectives

This course aims at providing knowledge on

- Laboratory safety
- Handling glass wares
- Analysis of organic compounds
- Preparation of organic compounds

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**Cognitive Level**
CO-1	observe the physical state, odour, colour and solubility of the given organic compound.	K1
CO-2	identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.	K2
CO-3	compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non- reducing sugars and explain the reactions behind it.	K3
CO-4	exhibit a solid derivative with respect to the identified functional group.	K4
CO-5	assess the yield of organic compounds and separation of compounds by chromatography and electrophoresis.	K5

UNIT I

Safety rules, symbols and first-aid in chemistry laboratory

Basic ideas about Bunsen burner, its operation and parts of the flame.

Chemistry laboratory glassware –basis information and uses

Unit II Qualitative Organic Analysis

Preliminary examination, detection of special elements - nitrogen, sulphur and halogens

Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests

Confirmation of functional groups

- monocarboxylic acid, dicarboxylic acid
- monohydric phenol, polyhydric phenol
- aldehyde, ketone, ester
- carbohydrate (reducing and non-reducing sugars)
- primary, secondary, tertiary amine
- monoamide, diamide, thioamide
- anilide, nitro compound

Preparation of derivatives for functional groups

UNIT III

Preparation of Organic Compounds

i. Nitration - picric acid from Phenol
ii. Halogenation - p-bromo acetanilide from acetanilide
iii. Oxidation - benzoic acid from Benzaldehyde
iv. Microwave assisted reactions in water:
v. Methyl benzoate to Benzoic acid
vi. Salicylic acid from Methyl Salicylate
vii. Rearrangement - Benzil to Benzilic Acid
viii. Hydrolysis of benzamide to Benzoic Acid

Separation and Purification Techniques (Not for Examination)

1. Purificationof organic compounds by crystallization (from water / alcohol) and distillation

2. Determination of melting and boiling points of organic compounds.

3. Steam distillation - Extraction of essential oil from citrus fruits/eucalyptus leaves.

4. Chromatography (any one) (Group experiment)

(i) Separation of amino acids by Paper Chromatography

(ii)Thin Layer Chromatography - mixture of sugars / plant pigments /permanganate dichromate.

(iii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate.

5. Electrophoresis – Separation of amino acids and proteins. (Demonstration)

Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5 & 6–not for ESE)

Reference Books

1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012.
2. Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018.
3. Gurtu, J. N; Kapoor, R. Advanced Experimental Chemistry (Organic), Sultan Chand: New Delhi, 1987.
4. Furniss,B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, 5th ed.; Pearson: India,1989.

Website and e-learning source

https://www.vlab.co.in/broad-area-chemical-sciences

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER II			
GENERIC ELECTIVE II - FUNDAMENTALS OF BOTANY II			
Course Code:23UBOE21	**Hrs/Week : 4**	**Hrs/ Semester: 60**	**Credits:4**

OBJECTIVES

1. To be familiar with the morphology of flowering plants including its vegetative and floral structure.
2. To know the basic concepts of classification and characteristic features of the selected families.
3. To understand the internal tissue organization of various plant organs.
4. To comprehend the structural organization of flower with relevance to the process of pollination and fertilization.
5. To learn about the physiological processes that underlie plant metabolism.

COURSE OUTCOMES

CO. No.	On completion of this course, the students will be able to:	PO
CO1	recall on classification, describe the morphology of flowering plants, tissues, anther, ovules and absorption of water	**K1**
CO2	illustrate vegetative, floral characters, economic importance of selected families, endosperm, pollination and imbibition	**K2**
CO3	compile the primary structure of root and stem of dicot and monocot. classify the flowering plants and growth hormones	**K3**
CO4	analyze the different types of ovules. compare the structural organization of flower in relation to the process of pollination fertilization and photophosphorylation	**K4**
CO5	examine and identify the locally available plants prescribed in the syllabus and evaluate water relation of plants with respect to various physiological processes.	**K5**

SEMESTER II			
GENERIC ELECTIVE II - FUNDAMENTALS OF BOTANY II			
Course Code:23UBOE21	**Hrs/Week : 4**	**Hrs/ Semester: 60**	**Credits:4**

UNITI **Morphology of flowering plants:** Taxonomy: definition and scope. Modification of root and stem. Leaf: venation, leaf apices, leaf margins, leaf arrangements. Stipules: types and modification. Inflorescence: types of inflorescences (Racemose, cymose and special). Flower: terms used in description of calyx, corolla, androecium and gynoecium.

UNITII **Classification and description of plants:** Systems of classification: natural (Bentham and Hooker (1862- 1883)) and phylogenetic (Engler and Prantl's system (1877-1899). Vegetative, floral characters and economic importance of following families: Dicotyledons: Polypetalae: Annonaceae, Rutaceae and Caesalpiniaceae. Gamopetalae: Rubiaceae and Asclepiadaceae. Monochlamydeae: Amaranthaceae and Euphorbicaeae. Monocotyledons: Cannaceae and Poaceae

UNITIII **Anatomy:** Tissues: Definition, Types: Simple tissues - parenchyma, collenchyma and sclerenchyma. Complex tissues – xylem and phloem. Primary structure of root and stem of dicot and monocot. Anatomy of leaf: dorsiventral and isobilaterial.

UNITIV **Embryology:** Structure of mature anther and ovule, Types of ovules, structure of pollen grain, structure and types of embryo sac, Endosperm types and functions, types of pollination, Double fertilization, structure of dicot and monocot embryo and seeds.

UNITV **Plantphysiology:** Absorption of water and its types (active and passive absorption). Photosynthesis: light reaction, Calvin cycle. Respiration: Glycolysis, Krebs cycle, electron transport system and oxidative phosphorylation. Growth hormones: auxins, gibberellins, ethylene and cytokinins and their applications.

Recommended Texts

1. Pandey, B.P. 2013. Taxonomy of Angiosperms, S. Chand Publishing, New Delhi.
2. Sharma, O.P. 2017. Plant Taxonomy. (II Edition). The McGraw Hill Companies. New York
3. Singh, G. 2007. Plant systematics theory and practices. Oxford and IBH Publishing Co. Shahpur, Delhi.
4. Sharma, P.C. 2017. Text Book of Plant Anatomy. Arjun Publishing House, New Delhi.
5. Pandey. S.N and Ajanta Chandha. 2006. Plant Anatomy and Embryology. Vikas Publishing House Pvt. Ltd, New Delhi
6. Bhojwani, S. S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6^{th} revised and enlarged edition).Vikas Publishing House, NewDelhi.
7. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms.Intl. Soc. Plant Morphologists, New Delhi.
8. Salisbury, F. B. C. W. Ross. 1991. Plant Physiology. Wassworth Pub. Co. Belmont. California
9. Jain, V.K. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd., New Delhi.

Reference Books

1. Vashista P.C.1985.Taxonomy of Angiosperms. Vikas Publications. New Delhi.
2. Bhojwani,S.S and Bhatnagar, S.P. 2000.The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, NewDelhi.
3. Pandey,B.P. 2012.PlantAnatomy.SChandPublishing. New Delhi
4. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P)Ltd. New Delhi.
5. Verma, S.K. 2006. A Text book of Plant Physiology, S.K. Chand and Co., New Delhi

Web resources

1. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y
2. https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=y
3. https://archive.org/EXPERIMENTS/plantanatomy031773mbp
4. https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG
5. https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	3	1	3	3	3	3	1
CO2	3	2	3	3	3	3	3	3	3	2
CO3	3	2	3	2	1	3	3	3	3	1
CO4	3	2	2	2	1	3	3	2	3	2
CO5	3	3	2	2	2	3	2	3	2	2
Avg	3	2	2.6	2.4	1.6	3	2.8	2.8	2.8	1.6

S-Strong (3) M-Medium (2) L-Low (1)

SEMESTER II			
GENERIC ELECTIVE PRACTICAL II- FUNDAMENTALS OF BOTANY II PRACTICAL II			
Course Code: 23UBOER2	**Hrs/Week : 2**	**Hrs/ Semester: 30**	**Credits:1**

OBJECTIVES

1. To be familiar with morphology of flowering plants.
2. To enhance information on the identification of each taxonomical group of flowering plants
3. Understanding the Plant anatomy in plant production systems
4. To study the different types of embryos
5. To learn about the physiological processes that underline plant metabolism.

COURSE OUTCOMES

CO. No.	On completion of this course, the students will be able to:	PO
CO1	describe the morphological features and architecture of floral components, categorize the types of inflorescences and the primary structure of stem and root	**K1**
CO2	understand the natural and phylogenetic classification with reference to vegetative and floral characters	**K2**
CO3	demonstrate the primary structure of stem and root of dicot and monocot, dissection of embryos from *Tridax*	**K3**
CO4	analyze the different types of flowers, ovules, embryo and endosperm	**K4**
CO5	estimate the effect of various physical factors on photosynthesis.	**K5**

SEMESTER II			
GENERIC ELECTIVE PRACTICAL II- FUNDAMENTALS OF BOTANY II PRACTICAL II			
Course Code: 23UBOER2	**Hrs/Week: 2**	**Hrs/ Semester: 30**	**Credits:1**

1. To dissect a flower, construct floral diagram and write floral formula.
   - Anonaceae - *Anona squamosa* and *Polyalthia longifolia*
   - Rutaceae - *Murraya koenigii* and *Citrus limon*
   - Caesalpiniaceae - *Caesalpinia pulcherima* and *Cassia auriculata*
   - Rubiaceae - *Ixora coccinea* and *Oldenlandia umbellata*
   - Asclepiadaceae - *Calotropis gigantea* and *Cryptostegia grandiflora*
   - Euphorbiaceae - *Euphorbia cyathophora* and *Phyllanthus amarus*
   - Amaranthaceae - *Amaranthus spinosus* and *Achyranthes aspera*.
2. **Experiments on Physiology**
   - Imbibition by direct weight method.
   - Determination of effect of light intensity on photosynthesis
3. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
   - Sectioning of stem - Dicot (*Polyalthia*), Monocot (*Zea mays*).
   - Sectioning of root - Dicot (*Azadirachta*), Monocot (*Crinum*).
   - Sectioning of leaf - Dicot (*Mangifera*), Monocot (Grass)
4. Structure of young and mature anther (permanent slide)
5. **Types of ovule:**
   - Anatropus (permament slide), orthotropus, circinotropus, amphitropus, campylotropus (models)
6. Dissection of embryo from *Tridax.*

Recommended Text

1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. PrenticeHall of India, New Delhi.
3. Cutler, D.F., Botha, C.E.J., Stevenson, D.W., and William, D. 2008. Plant anatomy: an applied approach (No. QK641 C87). Oxford: Blackwell, UK.
4. Sundara, R. S. 2000. Practical manual of plant anatomy and embryology. Anmol Publ. PVT LTD, New Delhi.

Reference books

1. Mathew K.M. 1981-84. The flora of Tamil Nadu, Carnatic. Volume I to III. Rapinet herbarium, St. Joseph's College. Tiruchirapalli.
2. Ashok Bendre and Ashok Kumar.1976. Text Book of Practical Botany II. Meerut: Rastogi Publications.
3. Gamble J.S. 1997. Flora of Presidency of Madras, Volume I to III, London: Adlard and Son., Ltd.
4. SundaraRajan, S, 2003. Practical Manual of Plant Anatomy and Embryology 1st ed, Anmol Publications, ISBN-812610668.
5. Katherine Esau. 2006. Anatomy of Seed Plants. 2nd edition, John Wiley and Sons.

Web resources

1. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y
2. https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=y
3. https://archive.org/EXPERIMENTS/plantanatomy031773mbp
4. https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	2	1	3	1	3	3	1
CO2	3	3	2	1	2	3	2	3	3	1
CO3	3	3	3	1	1	3	3	3	2	1
CO4	3	3	2	1	1	3	3	3	2	1
CO5	3	3	3	2	1	2	1	3	3	2
Avg	3	3	2.2	1.4	1.2	2.8	2	3	2.6	1.2

S – Strong (3) M- Medium (2) L- Low (1)

SEMESTER – II			
Part III Generic Elective II - Mathematics - II			
Code :23UMAE21	**Hrs/week : 6**	**Hrs/Sem : 90**	**Credits : 5**

Objectives:

- To know the concepts of vector differentiation and vector integration.
- To help students to appreciate the uses of derivatives and integrals in day today life and solve real life problems.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	recall and list the fundamental concepts of vector differentiation, including the definitions and properties of gradient, divergence, and curl.	K1
CO-2	demonstrate a clear understanding of the principles underlying the evaluation of double and triple integrals, illustrating the relationships between variables and integrals.	K2
CO-3	apply vector integration techniques to solve problems involving line, surface, and volume integrals, showcasing their ability to use these concepts in practical scenarios.	K3
CO-4	analyse and interpreting the implications of Green's, Stoke's, and Divergence theorems (without proof), solving problems that require the application of these theorems.	K4
CO-5	create solutions utilizing Fourier series, demonstrating an ability to identify even and odd functions, and construct half-range Fourier series from given functions.	K5

SEMESTER – II			
Part III Generic Elective II- Mathematics - II			
Code : 23UMAE21	**Hrs/week : 6**	**Hrs/Sem : 90**	**Credits : 5**

UNIT I

Vector differentiation–Gradient–Divergence and curl.

UNIT II

Evaluation of double and triple integrals

UNIT III

Vector integration–Line, surface and volume integrals.

UNIT IV

Green's, Stoke's and Divergence theorems(without proof)– simple problems.

UNIT V

Fourier series–Even and odd functions–Half range Fourier series.

Text Book

1. S. Arumugam&Issac, Allied Mathematics, New Gamma Publishing House (2012), Palayamkottai.

Reference Books

1. Narayanan S., Kandaswamy P., Hanumantha Rao R., Manicavachagom Pillay T.K., **Ancillary Mathematics Vol. - I**, S.Viswanathan (Printers & Publishers), Pvt., Ltd., 2010
2. Narayanan S., Kandaswamy P., Hanumantha Rao R., Manicavachagom Pillay T.K., **Ancillary Mathematics Vol. - II**, S.Viswanathan (Printers & Publishers), Pvt., Ltd., 2010.

Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	1	2	2	1	2	3	2	2
CO-2	2	2	2	2	3	2	3	2	2	3
CO-3	3	2	2	2	2	2	2	2	2	3
CO-4	3	3	2	2	2	2	3	3	2	2
CO-5	2	2	2	2	2	2	2	2	2	3
Ave.	2.6	2.2	1.8	2.0	2.2	1.8	2.4	2.4	2	2.6

SEMESTER II			
Part IV	**SEC II**	**Dairy Chemistry**	
Code : 23UCHSE2	**Hrs/Week:2**	**Hrs/ Sem: 30**	**Credits:2**

Objectives

This course aims at providing an overall view of the

- Chemistry of milk and milk products
- Processing of milk
- Preservation and formation of milk products.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	understand about general composition and microbiology of milk, chemistry of creaming process and types of milk and milk products.	K1
CO-2	acquire knowledge about milk constituents, pasteurization of Milk, major milk products, special milk, fermented and other milk products.	K2
CO-3	learn about physical properties and factors affecting the composition of milk, chemical changes in milk processing, common adulterants and their detection, composition and nutritive value of special milk and composition of various milk products.	K3
CO-4	explain about estimation of fat and total solids in milk, physiochemical changes in milk processing, antioxidants, synergists in milk products, definition and composition of various milk, definition and condition for cultured fermented and butter milk	K4
CO-5	have an idea about composition and constituents of milk, processing of milk, adulterants and their detection, flow diagram for manufacture of various special milk, types of drying and drying process in milk powder.	K5

UNIT I Composition of Milk

Milk-definition-general composition of milk- constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity -Factors affecting the composition of milk - adulterants, preservatives with neutralizer- examples and their detection- estimation of fat- acidity and total solids in milk.

Unit II Processing of Milk

Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing - boiling- pasteurization – types of pasteurization -Bottle- Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.

UNIT III Major Milk Products

Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition -composition - theory of churning – desi butter - salted butter- estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity - definition - prevention - antioxidants and synergists - natural and synthetic.

UNIT IV Special Milk

Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk -condensed milk - definition- composition and nutritive value.

UNIT V Fermented and other Milk Products

Fermented milk products – fermentation of milk - definition- conditions- cultured milk - definition of culture - example- conditions - cultured cream- butter milk - Bulgarious milk -acidophilous milk – Yoheer Indigeneous products- khoa and chhena definition - Ice cream -definition-percentage composition-types-ingredients-manufacture of ice–cream- stabilizers emulsifiersandtheirrole-milkpowder-definition-needformakingmilkpowderdryingprocess-types of drying.

Recommended Text

1. K. BagavathiSundari, Applied Chemistry, MJP Publishers, first edition, 2006.
2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974.
3. Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1 st edition, 2008.
4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition,2013.
5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.

Reference Books

1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005.
2. F.P.Wond, Fundamentals of Dairy Chemistry,Springer,Singapore,2006.
3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980.
4. P.F.Foxand P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016.
5. Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A. OMahony, Springer, Second edition, 2015.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	1	3	2	3	2	3	3	3
CO-2	3	2	2	3	2	3	2	3	2	3
CO-3	3	2	2	3	2	3	2	3	2	3
CO-4	3	2	2	3	2	2	2	3	2	3
CO-5	3	1	1	3	2	3	2	3	3	3
Ave.	3	1.6	1.6	3	2	3	2	3	2.4	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER II			
Part IV SEC III (Discipline Specific) Cosmetics And Personal Grooming			
Code : 23UCHSE3	**Hrs/Week:2**	**Hrs/ Sem: 30**	**Credits:2**

Objectives

This course aims at familiarizing the students with

- Formulations of various types of cosmetics and their significance
- Hair, skin and dental care
- Makeup preparations and personal grooming

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	know about the composition of various skin care, hair care, make up, perfume products and about beauty treatments. .	K1
CO-2	understand chemical aspects and applications of skin care, hair care, and dental care, make up, perfumes and beauty treatments.	K2
CO-3	understand formulation and advantage of perfumes and skin care, dental care, make up products, various methods of beauty treatments.	K3
CO-4	to understand the methods of skin cleansing, hair and dental cleaning, types of base, foundation, characteristics of perfumes, beauty treatments their advantages and disadvantage	K4
CO-5	understand the hazards of skin care, hair care, make up, perfume products and about beauty treatments.	K5

Unit I Skin care

Nutrition of the skin- skin care and cleansing of the skin; creams and lotions – cleansing- moisturizing all purpose- shaving and sunscreen (formulation only); Gels – formulation and advantages; astringent and skin tonics – key ingredients- skin lightness- depilatories.

Unit II Hair care

Shampoos – types – powder- cream- liquid- gel – ingredients; conditioner – types – ingredients

Dental care Tooth powder – ingredients – mouth wash.

Unit III Make up

Base – foundation – types – ingredients; lipstick- eyeliner- mascara- eye shadow- concealers- rouge

Unit IV Perfumes

Classification - Natural – plant origin – parts of the plant used- chief constituents; animal origin – amber gries from whale- civetone from civet cat- musk from musk deer; synthetic – classification emphasizing characteristics – esters – alcohols – aldehydes – ketones.

Unit V Beauty treatments

Facials - types – advantages – disadvantages; face masks – types; bleach - types – advantages– disadvantages; shaping the brows; eyelash tinting; perming – types; hair colouring and dyeing (natural and chemical methods) ; permanent waving – hair straightening; wax – types – waxing; pedicure- manicure - advantages – disadvantages.

Recommended Text

1. Thankamma Jacob, (1997) Foods, drugs and cometics – A consumer guide, Macmillan publication, London.

Reference Books

1. Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed., Chemical Publishers, London.
2. George Howard, (1987) Principles and practiceof perfumes and cosmetics, Stanley Therones, Chettenham

Website and e-learning source

1. http://www.khake.com/page75.html
2. Net.foxsm/list/284

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	1	3	2	3	2	3	2	3
CO-2	3	2	2	3	2	3	2	3	2	3
CO-3	3	2	2	3	2	3	2	3	2	3
CO-4	3	2	2	3	2	2	2	3	2	3
CO-5	3	2	1	3	2	3	2	3	2	3
Ave.	3	2	1.6	3	2	3	2	3	2	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER – III			
Part-I Tamil Paper - 3 காப்பிய இலக்கியங்கள் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, புதினம்			
23ULTA31	Hrs / Week:6	Hrs / Semester: 90	Credits: 4

நோக்கங்கள்

	கற்றல் நோக்கங்கள்
1	நம் தாய்மொழியில் உள்ள அரிய பொக்கிசங்களான காப்பியங்களை, அவற்றின் உட்கருத்தை மாணவியர் அறிந்துகொள்வர்.
2	சங்ககாலம் முதல் இக்காலம் வரை பல்வேறு சமயங்களின் வளர்ச்சி நிலைகள் பற்றியும் இக்காப்பியங்கள் வழி அறிந்து கொள்வர்.
3	வாழ்வுக்கு இலக்கணம் கூறும் அகப்பொருள் இலக்கணம் பற்றி அறிந்து கொள்வர்.
4	இலக்கிய வரலாற்றின் வழி மொழியின் வளர்ச்சியையும் காலந்தோறும் மாறிவரும் இலக்கியங்களின் பல்வேறு வகைகளையும் தெரிந்து கொள்வர்.
5	தன்னம்பிக்கை உருவாக்கி, வேலை வாய்ப்பிற்கான தேர்வுகளில் திறமையுடன் பங்கேற்பர்.

பாடத்திட்டத்தின் பயன்கள்

CO.NO	இப்பாடத்திட்டம் - மாணவியரிடம்	அறிவாற்றல் திறன்
CO-1	இலக்கிய அறிவையும், காப்பிய அறிமுகம் மற்றும் கருத்து நலம் குறித்த புலமையை வளர்க்கிறது	K1
CO-2	கடல் போன்ற தமிழ் இலக்கியக் கனிச் சாற்றை மேன்மேலும் பருக வேண்டும் என்னும் ஆவலை வளர்க்கிறது.	K2
CO-3	மொழியறிவோடு சிந்தனைத்திறனையும், படைப்பாற்றலையும் வளர்க்கிறது.	K3
CO-4	சங்க கால மக்களின் வாழ்க்கைச் சுவடு, மற்றும் வாழ்வியல் பண்பாட்டு நெறிகளின் தாக்கம் பெற்றுத் தங்களின் எதிர்கால வாழ்வைச் செம்மையுடன் அமைக்கும் திறனைப் பெறுகிறார்கள்.	K4
CO-5	தனிமனித, சமுதாய வாழ்க்கைச் சிக்கல்களை எதிர்கொண்டு வெற்றியோடு பயணிக்கும் திறனைப் பெறுகிறார்கள்.	K5

அலகு 1 **(18 மணி நேரம்)**

பெருங்காப்பியங்கள்

1. சிலப்பதிகாரம் - வழக்குரைகாதை - இளங்கோவடிகள்
2. மணிமேகலை - ஆதிரை பிச்சையிட்ட காதை – சீத்தலைச் சாத்தனார்
3. சீவக சிந்தாமணி - பூமகள் இலம்பகம் - திருத்தக்கத்தேவர்
4. வளையாபத - நாதகுத்தனார்

அலகு – 2 **(18 மணி நேரம்)**

சமய காப்பியங்கள்

1. பெரியபுராணம் - பூசலார் நாயனார் புராணம் - சேக்கிழார்
2. கம்பராமாயணம் - மந்தரை சூழ்ச்சிப் படலம் - கம்பர்
3. இயேசு காவியம் - மலைப் பொழிவு – கண்ணதாசன்
4. சீறாப்புராணம் - புலி வசனித்த படலம் - உமறுப் புலவர்

அலகு – 3 **(18 மணி நேரம்)**

இலக்கணம்

1. **அகப்பொருள்:**
    1. ஏழு திணை விளக்கம்
    2. முதல், கரு, உரிப் பொருள் - விளக்கம்
2. **புறப்பொருள்:**
    1. வெட்சி முதல் பாடாண் திணை வரை - விளக்கம
3. **யாப்பின் இலக்கணம்**

அலகு – 4 **(18 மணி நேரம்)**

இலக்கிய வரலாறு

1. ஐம்பெருங் காப்பியங்கள்
2. ஐஞ்சிறு காப்பியங்கள்
3. சிற்றிலக்கியங்கள்

அலகு – 5 **(18 மணி நேரம்)**

புதினம்

1. வஞ்சிமாநகரம் (வரலாற்றுப் புதினம்) – நா.பார்த்த சாரதி

துணைநின்ற நூல்கள்

1. சிலப்பதிகாரம் - புலவர் பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.
2. மணிமேகலை - புலவர் பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.

3. .சீவகசிந்தாமணி - புலவர் பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

4. கம்பராமயணம் - பேரா. பூவண்ணன்(உரையாசிரியர்)
வர்த்தமானன் பதிப்பகம்
21, இராமகிரு‘ணா தெரு
தியாகராய நகர்
சென்னை – 17.

5. பெரியபுராணம் - பன்னிரு திருமுறைகள்
ச.வே.சுப்பிரமணியன்
மணிவாசகர் பதிப்பகம்
31, சிங்கர் தெரு
பாரிமுனை, சென்னை – 18.

6. இயேசு காவியம் - கவிஞர் கண்ணதாசன்,
கண்ணதாசன் பதிப்பகம்
கலைக்காவிரி வெளியீடு,
திருச்சி .

7. ஐஞ்சிறுகாப்பியங்கள் (மூலமும் உரையும்) – தமிழ் நிலையம்
40, சரோஜினி தெரு
தியாகராய நகர்
சென்னை – 17

8. புறப்பொருள் வெண்பாமாலை - பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

பார்வை நூல்கள்

1. தொல்காப்பியம் - பொருளியல் உரைவளம் - க. வெள்ளைவாரணன்
பதிப்:புத் துறை,
மதுரை காமராசர் பல்கலைக் கழகம்,
மதுரை- 625 021.
முதற்பதிப்பு - 1983

7. நன்னூல் - பவணந்தி முனிவர்
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

8. தமிழ் இலக்கிய வரலாறு - தமிழ்த்துறை தொகுப்பு
தூய மரியன்னை கல்லூரி (தன்னாட்சி), தூத்துக்குடி.

இணைய ஆதாரங்கள்

1. Project Madurai - www.projectmadurai.org
2. Tamil Universal Digital Library – www.ulib.prg<http://www.ulib.prg>

3. Tamil Books on Line – books.tamilcube.com

Course Outcomes (PO)	Programme Specific Outcomes (PSO)				
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	3
CO-2	2	3	2	1	1
CO-3	3	2	2	2	3
CO-4	1	3	3	2	2
CO-5	3	1	2	2	3
Ave	2.4	2.1	2.3	1.8	2.4

Maping	**<40%**	**≥ 40%and<70%**	**≥70%**
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER – III			
Part I French	**French Literature and Grammar I**		
Course Code: 23ULFA31/ 23ULFB31	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Learning Objectives:

- To get a gist of the French Literature.
- To appreciate the essence in the literary texts
- To develop an interest in the French literature that will encourage her to pursue higher studies in French.
- To identify the grammar used in the literary texts and advance into complicated grammar.

Course Outcomes		
Course Outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO-1	comprehend the history of the French literature.	K1
CO-2	interpret the values and morals through literary texts.	K2
CO-3	imbibe the basic grammatical structures of the French language	K3
CO-4	compare literary texts of different centuries to note the difference in writings.	K4
CO-5	estimate the humanistic value about author's ideas and transform her own personality	K5

SEMESTER – III			
Part I French	**French Literature and Grammar I**		
Course Code: 23ULFA31/ 23ULFB31	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Unit I – Moyen Age

1.1 – Estula - Auteur Anonyme
1.2 – Balade des pendues – François Villon
1.3 – Les pronoms COD et COI

Unit II – XVI^{e} siècle

2.1 – Regrets - Joachim du Bellay
2.2 – Gargantua - François Rabelais
2.3 – Le futur proche/ Passe récent

Unit III – XVII^{e} siècle

3.1 - La cigale et la fourmi - Jean de la Fontaine
3.2 – Sur la mort de son fils - François de Malherbe
3.3 – Le passe compose avec avoir et être

Unit IV – Francophonie - Québec

4.1 – Une saison dans la vie d'Emmanuel - Marie Claire Blais
4.2 – L'imparfait
4.3 – Le passe compose et l'imparfait

Unit V – Francophonie – Afrique Noire

5.1 – L'enfant noir - Camara Laye
5.2 – L'impératif
5.3 – Le futur simple

Textbook:

- Textes complié par le département de français
- Clémence Fafa, Yves Loiseau, Violette Petitmengin, *Grammaire Essentielle Du Français A1*, Didier, 2018

Books, Journals and Learning Resources

- K. Madanagobalane, N.C.Mirakamal. *Le Francais par les Textes*. Chennai : Samhita Publications, 2019.
- Ludivine Glaud, Muriel Lannier, Yves Loiseau, *Grammaire Essentielle Du Français A1 A2*, Didier, 2015
- Blondeau Nicole, Allouache Ferroud jà, Ne Marie-Françoise. *Littérature Progressive du Français*. Paris : CLE International, 2004.
- Akyuz Anne, Bazelle-Shahmaei Bernadette, Bonenfant Joelle, Gliemann Marie-Francoise. *Les 500 exercices de grammaire*. Paris : Hachette livre, 2005
- Grégoire Maria. *Grammaire Progressive du français*. Paris : CLE International, 2002.

- Sirejols Evelyne, Tempesta Giovanna,Grammaire. *Le Nouvel Entrainez-vous avec 450 Nouveaux Exercices.* Paris : CLE International, 2002
- www.francaisfacile.com/exercices/
- www.bonjourdefrance.com
- https://www.conte-moi.net/node/120

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	1	3	2	2	1	2	3	3
CO-2	3	2	2	2	2	2	2	3	3	3
CO-3	3	3	1	2	2	3	3	2	2	3
CO-4	3	3	2	2	1	1	2	2	3	3
CO-5	2	1	2	3	3	1	2	3	3	3
Ave.	2.8	2.2	1.6	2.4	2	1.8	2	2.4	2.8	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER – III			
Part II English Poetry, Prose, Extensive Reading and Communicative English - III			
Course Code: 23UGEN31	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Objectives:

- To enable the learners, experience the literary works.
- To use English effectively for study purpose across the curriculum.
- To develop interest in the appreciation of Literature.
- To develop and integrate the use of LSRW skills.

Course Outcomes:

CO. No.	Upon completion of the course, the students will be able to	PSO Addressed	K Level
CO -1	identify the central themes of the literary texts.	1,3	1
CO - 2	express the correct usage of English Grammar in writing and speaking.	2,3	2
CO - 3	show their reading fluency skills through extensive reading.	2,3	3
CO - 4	analyse and appreciate literary works.	3,4	4
CO - 5	evaluate and integrate the use of the four language skills.	5	5

SEMESTER - III			
Part II English	**Poetry, Prose, Extensive Reading and Communicative English - III**		
Course Code: 24UGEN31	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Unit I – Poem

William Wordsworth (1770- 1850) : The Stolen Boat
William Blake (1757- 1827) : Auguries of
Innocence Rabindranath Tagore (1861-1941) : Fairyland
W.H. Davies (1871-1940) : Leisure

Unit II – Prose

A.G. Gardiner (1865- 1946) : On Cats and Dogs
Wangari Maathaai (1940 – 2011) : Nobel Prize Acceptance Speech

Unit III – Short Story

Leo Tolstoy (1828 – 1910) : How Much Land Does a Man Need
O' Henry (1862- 1910) : The Gift of the Magi
Washington Irving (1783 – 1859) : Rip Van Wrinkle

Unit IV – Grammar

Phrasal Verbs &
Idioms Modals and
Auxiliaries
Verb Phrases – Gerund, Participle and Infinitives

Unit V – Composition / Writing Skills

Brochures for Programmes and Events (Drafting Invitations)
Official Correspondence – Leave Letter, Letter of Application & Permission Letter

Text Books (Latest Editions)

1.Joseph, K.V. *A Textbook of English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited, 2006.
2. Green, David. *Contemporary English Grammar Structures and Composition*. 2nd Edition. Bengaluru: Trinity Press, 1971.

Web Resources

WangariMaathai – Nobel Lecture. Nobel Prize Outreach AB 2023. Jul 2023. https://www.thoughtco.com/usage-grammar-1692575
https://grammar.yourdictionary.com/

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO- 1	**PO-2**	**PO-3**	**PO- 4**	**PO- 5**	**PSO- 1**	**PSO- 2**	**PSO- 3**	**PSO- 4**	**PSO- 5**
CO-1	3	2	3	3	2	3	2	3	2	2
CO-2	2	3	3	3	3	2	3	2	2	3
CO-3	3	3	3	3	3	3	3	2	2	3
CO-4	2	3	3	3	2	2	3	3	2	2
CO-5	3	3	3	2	2	3	3	3	3	2
Ave.	2.6	2.8	3	2.8	2.4	2.6	2.8	2.6	2.2	2.4

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

Semester III			
Part III	**Core III General Chemistry-III**		
Code: 23UCHC31	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 5**

Objectives

This course aims to provide a comprehensive knowledge on

- The physical properties of gases, solids and X-ray diffraction of solids.
- Fundamentals of qualitative and quantitative analysis.
- Applications of liquid crystals.
- Basic chemistry of halo-organic compounds, phenol and other aromatic alcohols.
- Preparation and properties of phenols and alcohols.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	explain the kinetic properties of gases, the principal of titrations, properties of liquids, solids, halo-compounds and phenols	K1
CO-2	describe ideal and real gases, various types of crystals , concept of solubility and explain the preparation of organic halides and phenols	K2
CO-3	investigate cations and anions present in the sample, shapes of crystals, deviations of real gases and isomerism in organic compounds	K3
CO-4	apply XRD for the calculation of crystal structures, group separation for the determination of acid and base radicals, isotherms of real gases, write basic reaction mechanisms of halo organic compounds, phenols and alcohols.	K4
CO-5	evaluate the concentration of acids and bases using volumetric analysis and the mechanisms of various organic reactions.	K5

UNIT I Gaseous state

Kinetic molecular model of a gas - postulates and derivation from the kinetic gas equation - The Maxwell – Boltzmann distribution of speed of molecules- average - root mean square - most probable velocity and average kinetic energy - law of equipartition of energy- degrees of freedom and molecular basis of heat capacities. Collision frequency - collision diameter - mean free path and viscosity of gases. Real gases: Deviations from ideal gas behaviour (Andrew's and Amagat's plots); compressibility factor Z- and its variation with pressure for different gases - equations of states for real gases-van der Waal's equation - Virial equation- Boyle temperature - Numerical problems based on equations of states for real gases- isotherms of real gases – critical phenomena – isotherms of CO_2 - continuity of state–Van der waal's equation and the critical state; law of corresponding states-liquefaction of gases- numerical problems involving the core concepts**.**

Unit II Solid State

Crystalline and amorphous – differences – geometry- isotropy and anisotropy- melting point; isomorphism - polymorphism.

Crystals –size and shape - laws of crystallography- symmetry elements – plane centre and axis- Miller indices- unit cells and space lattices- classification of crystal systems- Bravais lattices - X – ray diffraction – Bragg's equation

Packing in atomic solids – simple cubic- body centered cubic- face centered and hexagonal close packing - Co-ordination number in typical structures – NaCl, CsCl, ZnS, TiO_2 - comparison of structures and properties of diamond and graphite- numerical problems involving core concepts

Defects in solids - stoichiometric and nonstoichiometric defects (Schottky and Frenkel).

Liquid crystals – classification and applications. Crystal growth – Czochralsky method - hydrothermal method - gel method.

UNIT III Analytical Methods

Qualitative and Quantitative Analysis - Volumetric Analysis – Principle – Standard Solutions – Normality and Molarity – Principles of Titrations – Theory of Indicators - Types of Titrations – Acidimetry- Alkalimetry- Permanganometry- Dichrometry- Iodometry- Complexometry - Principles of gravimetric analysis – precipitation methods – conditions of precipitation – co-precipitation and post precipitation

Qualitative Inorganic Analysis – Dry Test- Flame Test- Wet Test – Common ion effect and solubility product - Testing of Simple and Interfering Acid Radicals- Test for sulphide- sulphate- nitrate (brown ring test)- bromide and iodide (silver nitrate test)- chloride and chromate (chromyl chloride test)- oxalate and fluoride (calcium chloride test)- borate (ethyl borate test)- phosphate (ammonium molybdate test) – Elimination of Interfering Acid Radicals- Chromate- Oxalate- fluoride- phosphate -Identifying the Groups of Basic Radicals – Testing of the Basic Radicals belonging to different Groups - Test for lead- copper- cadmium-

antimony- bismuth- cobalt- nickel- manganese- zinc- barium- strontium- calcium, magnesium and ammonium.

UNIT IV Halogen derivatives aliphatic halogen derivatives

Classes of alkyl halides – isomerism - physical properties- Chemical reactions -Nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects - effect of solvent.

Di, Tri & Tetra Halogen derivatives -Classification – preparation - properties -applications of 1,2 dichloroethane - Chloroform - Carbon tetrachloride

Aryl halides- preparation- properties –uses -Mechanism of nucleophilic aromatic substitution – benzyne intermediate.

Aryl alkyl halides- benzyl chloride – preparation – preparation- properties – uses

Alcohols- classification- preparation -properties- use of mono hydric alcohols- conversions – ascent and descent of series- test for hydroxyl groups-Oxidation of diols by periodic acid and lead tetraacetate.

UNIT V Phenols

Classification - Preparation from diazonium salts- cumene-Dow's process- Raching process- properties – acidic character and effect of substitution on acidity- Reactions – Fries- Claisen rearrangement, Electrophilic substitution reactions- Reimer – Teimen- Kolbe- Schmidt- Gatermann synthesis- Libermann reaction.

Resorcinol- quinol- picric acid – preparation - properties and uses.

Aromatic alcohols

Nomenclature- benzyl alcohol – methods of preparation – hydrolysis- reduction of benzaldehyde- Cannizzaro reaction- Grignard synthesis- physical properties- reactions – reaction with sodium- phosphorus pentachloride - thionyl chloride- acetic anhydride - hydrogen iodide- oxidation – substitution on the benzene nucleus- uses. Thiols - Nomenclature – structure- preparation - properties.

Recommended Text

1. B. R. Puri, L. R. Sharma, M. S. Pathania; *Principles of Physical Chemistry*, 46th edition, Vishal Publishing, 2020.
2. B. R. Puri, L. R. Sharma and K. C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.
3. P. L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & amp; Sons, twentieth edition, 2006.
4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.
5. S. M. Mukherji, and S. P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.

Reference Books

1. T. W. Graham Solomons, *Organic Chemistry*, John Wiley & Sons, fifth edition, 1992.
2. A. Carey Francis, *Organic Chemistry*, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, 2009.
3. I. L. Finar, *Organic Chemistry*, Wesley Longman Ltd, England, sixth edition, 1996.
4. P. L. Soni, and H. M. Chawla - *Text Book of Organic Chemistry*, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.
5. J.D. Lee, *Concise Inorganic Chemistry*, Blackwell Science, fifth edition, 2005.

Website and e-learning source

MOOC components

https://nptel.ac.in/courses/104104101 - Solid state chemistry

https://nptel.ac.in/courses/103106071 - Nuclear industries and safety

https://nptel.ac.in/courses/104106119 - Introduction to organic chemistry

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	2	2	2	3	2	2	1	1
CO-2	2	3	2	3	2	3	2	2	1	2
CO-3	3	3	2	2	2	3	2	2	1	3
CO-4	3	3	2	3	2	3	3	3	1	3
CO-5	3	2	2	3	3	3	3	3	1	3
Ave.	2.8	2.8	2	2.6	2.2	3	2.4	2.4	1	2.4

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Semester III			
Part III Semimicro Qualitative Analysis of Simple Inorganic Salts			
Code: 23UCHCR3	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives

This course aims at providing knowledge on

- Developing the skill on systematic analysis of simple inorganic salts.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	acquire knowledge on the systematic analysis of salts.	K1
CO-2	identify the cations and anions in the unknown substance.	K2
CO-3	identify the cations and anions in the soil and water and to test the quality of water.	K3
CO-4	assess the role of common ion effect and solubility product	K4
CO-5	evaluate quality of various samples by determining the anion and cations in them	K5

- Systematic qualitative analysis of a simple salt containing one anion and one cation. Anions may be simple or interfering.
- Principles of flame testing – concept of solubility and solubility product – concept of pH and Buffer action – common ion effect - theory of testing anions (Simple and interfering) – Principle of grouping of cations –Theory of testing cations.

Anions:

(i) Carbonate (ii) Nitrate (iii) Sulphate (iv)Sulphide (v) Borate (vi) Oxalate (vii) Fluoride (viii) Phosphate (ix) Chromate

Cations:

(i) Lead (ii) Copper (iii) Bismuth (iv) Cadmium (v) Cobalt (vi) Nickel (vii) Manganese (ix) Zinc (x) Barium (xi) Strontium (xii) Calcium (xiii) Magnesium (xiv) Ammonium.

Reference Books:

1. V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.

Website and e-learning source

https://www.vlab.co.in/broad-area-chemical-sciences

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	2	2	1	3	2	2	1	2
CO-2	3	2	2	2	1	3	2	2	1	3
CO-3	3	2	2	2	1	3	2	2	1	3
CO-4	3	2	2	2	1	3	2	2	1	3
CO-5	3	2	3	3	2	3	2	3	1	3
Ave.	3	2	2.2	2.2	1.2	3	2	2.2	1	2.8

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER- III			
Generic Elective III- Physics I (II B.Sc., Chemistry)			
Course Code: 23UPHE31	**Hrs/Week: 4**	**Hrs/ Semester: 60**	**Credits: 4**

Objectives:

- To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.

Course outcomes:

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

CO.No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Describe the basic principles of waves, oscillations, ultrasonics, properties of matter, heat and thermodynamics, electricity and magnetism and digital electronics	K1
CO-2	Interpret simple harmonics motion, elastic constants, Joule-Kelvin effect, BiotSavart's law and De-Morgan's law.	K2
CO-3	Apply the knowledge of ultrasonics in dentistry, molecular theory in preventing covid transmission through droplets, liquid oxygen for medical purpose, types of switches in household and factories, digital electronics in semiconductor laboratories.	K3
CO-4	Analyse the working of sonometer, drop weight method, heat engine, potentiometer and universal building blocks.	K4
CO-5	Judge the experimental work done, verifying the laws of transverse vibrations of strings, theory of non - uniform bending, laws of thermodynamics, principle of potentiometer and De-Morgan's theorem.	K5

SEMESTER- III			
Generic Elective III- Physics I (II B.Sc., Chemistry)			
Course Code: 23UPHE31	**Hrs/Week: 4**	**Hrs/ Semester: 60**	**Credits: 4**

Unit I: Waves, Oscillations and Ultrasonics

Simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – application of ultrasonics: medical field – lithotripsy, ultrasonography – ultra sono imaging- ultrasonics in dentistry – physiotheraphy, opthalmology – advantages of noninvasive surgery – ultrasonics in green chemistry.

Unit II: Properties of Matter

Elasticity: elastic constants – bending of beam – theory of non- uniform bending – determination of Young's modulus by non-uniform bending – energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum.

Viscosity: streamline and turbulent motion – critical velocity – coefficient of viscosity Poiseuille's formula – comparison of viscosities – burette method.

Surface tension: definition – molecular theory – droplets formation–shape, size and lifetime – COVID transmission through droplets, saliva – drop weight method – interfacial surface tension.

Unit III: Heat and Thermodynamics

Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– Linde's process of liquefaction of air– liquid Oxygen for medical purpose– importance of cryocoolers – thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process.

Unit IV: Electricity and Magnetism

Potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – types of switches in household and factories– Smart wifi switches- fuses and circuit breakers in houses.

Unit V: Digital Electronics and Digital India

Logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem – verification – overview of Government initiatives: software technological parks under MeitY, NIELIT-semiconductor laboratories under Dept. of Space – an introduction to Digital India.

Text Books

1. R.Murugesan (2001), AlliedPhysics,S. Chand&Co,NewDelhi.
2. Brijlal an dN.Subramanyam (1994), Waves and Oscillations, VikasPublishing House,NewDelhi.
3. Brijlal and N.Subramaniam (1994), Properties of Matter, S.Chand & Co.,NewDelhi.
4. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8th edition), S.Chand&Co.,New Delhi.
5. R.Murugesan(2005), Optics and Spectroscopy, S.Chand & Co,NewDelhi.
6. A.Subramaniyam, Applied Electronics, 2ndEdn.,NationalPublishingCo.,Chennai.

Reference Books

1. Resnick Halliday and Walker(2018).Fundamentals of Physics(11th edition),John Willey and Sons, Asia Pvt .Ltd., Singapore.
2. V.R. Khanna and R.S.Bedi (1998), TextbookofSound1stEdn. Kedharnaath Publish &Co, Meerut.
3. N.S.KhareandS.S.Srivastava(1983),ElectricityandMagnetism10thEdn.,AtmaRam&Sons, New Delhi.
4. D.R. Khanna and H.R. Gulati(1979). Optics, S. Chand &Co. Ltd.,New Delhi.
5. V.K. Metha(2004).Principlesofelectronics6thEdn. S.Chand and company.

Web Links

1. https://youtu.be/M_5KYncYNyc
2. https://youtu.be/ljJLJgIvaHY
3. https://youtu.be/7mGqd9HQ_AU
4. https://youtu.be/h5jOAw57OXM
5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
7. https://www.youtube.com/watch?v=gT8Nth9NWPM
8. https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s
9. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
10. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

Mapping with program outcomes and programme specific outcomes:

Map course outcomes (CO) for each course with program outcomes (PO)&Programme Specific Outcomes (PSO) in the 3-point scale of HIGH (3, ≥ 70%), MEDIUM (2, ≥ 40% and < 70%) and LOW (1,<40%).

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	2	1	1	1	1	1	1	1	1	1
CO-2	3	2	1	1	1	2	1	1	2	1
CO-3	3	2	3	3	1	3	3	2	3	3
CO-4	3	3	2	1	1	3	3	2	3	3
CO-5	3	3	2	2	1	3	3	3	3	3
Ave.	2.8	2.2	1.8	1.6	1	2.4	2.2	1.8	2.4	2.2

SEMESTER- III			
Generic Elective Practical III- Physics Practical I (II B.Sc., Chemistry)			
Course Code: 23UPHER3	**Hrs/Week: 2**	**Hrs/ Semester: 30**	**Credits: 1**

Objectives: Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

Any SEVEN

1. Young's modulus by non-uniform bending using pin and microscope
2. Young's modulus by non-uniform bending using optic lever, scale and telescope
3. Rigidity modulus by torsional oscillations without mass
4. Comparison of viscosities of two liquids – burette method
5. Verification of laws of transverse vibrations using sonometer
6. Calibration of low range voltmeter using potentiometer
7. Determination of thermo emf using potentiometer
8. Verification of truth tables of basic logic gates using ICs
9. Verification of De Morgan's theorems using logic gate ICs.
10. Use of NAND as universal building block.

SEMESTER III			
NME I	**Everyday Chemistry**		
Course Code: 23UCHN31	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives:

This course aims at providing knowledge on

- The purification process for drinking purpose.
- Classification of solid, liquid and gaseous fuels.
- The chemistry behind cosmetics.
- The manufacture of sugar.
- The preparation of candles, toothpowder.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	understand the environmental impact of everyday chemical usage and explore ways to make sustainable choices	K1
CO-2	gain knowledge of common household chemicals and safe handling practices to minimize risks in daily activities	K2
CO-3	develop problem solving skills to troubleshoot common chemical issues in household activities	K3
CO-4	develop a foundational understanding of basic chemical concepts, allowing for informed decision making in everyday life	K4
CO-5	apply chemical principles to practical situations such as cooking, cleaning and home maintenance	K5

UNIT I Water

Water as universal solvent-Hard and soft water-Purification of water for drinking purpose. Desalination- reverse osmosis- mineral water- pH of water for drinking purpose. Biological importance of water-water balance and electrolyte balance in human body. Water borne diseases and prevention.

UNIT II Fuels

Definition-Classification with examples (solid, liquid and gas)- calorific Value-Ignition temperature-Flash point. Characteristics of solid- liquid- and gaseous fuels and their applications. Nuclear fuels- Rocket fuels- Biofuels.

UNIT III Cosmetics

Facials - types – advantages – disadvantages; face masks – types; bleach - types – advantages– disadvantages; shaping the brows; eyelash tinting; perming – types; hair colouring and dyeing (natural and chemical methods) ; permanent waving – hair straightening; wax – types – waxing; pedicure- manicure - advantages – disadvantages.

UNIT IV Sugar and Paper Industry

Manufacture of sugar- recovery of alcohol from molasses- fermentation- and manufacture of beverages. Bagasse. Paper industry- Manufacture of paper.

UNIT V Chemicals in Day to Day Use

An Outline of the preparation and uses of the following:

a) Candle b) Tooth Powder c) Liquid blues d) Blackboard chalk e) Moth balls f) Soap g) Shampoo

h) Lipstick i) Phenoyle j) Eyetex k) Cleaning powder l) Face powder

Reference books

1. Jayashree Ghosh. *Fundamental concepts of Applied chemistry*. Edition, New Delhi, S. Chand & company Ltd., 2006.
2. Jain P.C and Monika Jain. *Engineering chemistry.* New Delhi, Dhanpat Rai & Sons, 2020.
3. Prakash Shetty. *Science and Technology of Printing materials* .Chennai: MJP Publishers, 2019.
4. Sharma B. K., *Industrial Chemistry.* Meerut: Goel Publishing House, 2003.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	1	2	1	3	2	3	2	1
CO-2	1	3	2	2	2	2	3	3	1	1
CO-3	3	1	1	2	2	3	2	3	2	3
CO-4	3	3	2	2	2	1	3	3	2	2
CO-5	1	3	3	3	1	3	1	3	2	3
Ave.	2.2	2.2	1.8	2.2	1.6	2.4	2.1	3	1.8	2.0

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER III			
Part IV	**Skill Enhancement Course IV Soil Chemistry**		
Course Code: 23UCHSE4	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives:

This course aims at providing knowledge on

- facilitating the students to know the basic knowledge about agriculture and soil
- the importance of agriculture
- the chemistry behind fertilizers and pesticides
- soil testing

Course Outcomes

CO No.	Upon completion of this course, students should be able to	Cognitive Level
CO- 1	understand the importance of soil its constituents, fertility and to promote agriculture.	K1
CO- 2	know the preparation and importance of fertilizers in agriculture	K2
CO- 3	realize the importance of pesticides and insecticides	K3
CO-4	rationalise the environmental hazards of pesticides	K4
CO- 5	know the importance and nature of soil	K5

Unit I Characteristics of soil

Physical aspects - soil texture - pore space - bulk density - particle density - soil colour – soil colloids. Properties of soil colloids – size and chemical composition- surface area- plasticity- swelling and shrinkage - flocculation and deflocculation -soil temperature and their importance in plant growth- soil air-factors affecting the composition of soil air- soil aeration and plant growth.

Unit II Chemistry of soil

Acid soil – origin of acid soils- effects of soil acidity on plants – Saline and alkaline soil – nature and classification- characteristics- formation- diagnosis of saline and sodic soils – Methods of soil reclamation – Buffer action- factors affecting buffering capacity of soil.

Unit III Fertilisers

Natural and synthetic manures-qualities of a good fertilizer- classification of fertilizers – nitrogeneous fertilizers - Preparation and importance of urea-calcium cyanamide - super phosphate-triple super phosphate- potassium chloride-potassium nitrate - DAP- mixed fertilizers (NPK) and human effluent from gobar gas plant as a manure. Vermiculture -vermi compost.

Unit IV Pesticides

Pesticides- Insecticides- Repellents- Fungicides- Definition-classification – on the basis of their mode of action- target organisms they control- method of application- environmental hazards - preparation and uses of DDT- BHC- lead arsenate- Bordeaux mixture. Bio pesticides – definition – examples – applications.

Unit V Soil and Water analysis

1. Analysis of carbon, nitrogen, potassium, phosphorous, zinc and calcium in soil using mini lab for soil analysis.
2. Determination of BOD and COD of water samples
3. Determination of pH and conductivity of water from different sources.
4. Determination of DO and hardness of water.

Industrial Visit:

A visit may be made to an industry or a premier institution. (Optional)

*A report of the industrial visit may be submitted as an assignment.

Recommended Texts

1. Jayashree Ghosh. *Text Book of Pharmaceutical Chemistry*. New Delhi: S. Chand and company, 2003.
2. Bagavathi Sundari K. *Applied Chemistry*. MJP Publishers, 2008.

Reference Books

1. Sharma B. K., *Industrial Chemistry*. Goel Publishing House. Fifth Edition, 1993-94.
2. Sindhu P.S., *Environmental Chemistry*. New Age International Publishers, 2010.
3. Dr Joshi. S.R, *Biopesticides- A Biotechnological Approach*. New Age International (P) Ltd., Publishers, 2020.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER III			
Ability Enhancement Course	**Yoga and Meditation**		
Course Code: 23UAYM31	**Hrs/Week: 1**	**Hrs/Semester: 15**	**Credits: 1**

Objectives

This course aims at providing knowledge on

- self -awareness and concentration.
- yoga and benefits of yoga asanas.
- the power of positive attitude.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	acquire knowledge in Meditation, awareness, different types of yoga mindfulness and attitude to life.	K1
CO-2	gain knowledge on Major types of meditation, self-awareness, basic asanas and three components of mindfulness, positive and negative attitude.	K2
CO-3	explain health benefits of meditation, concentration, asanas for healthy life, mindfulness and Brainwave patterns, heartfullness	K3
CO-4	understand better meditation, levels of concentration, surya namaskar, Myths about mindfulness, feat and its types.	K4
CO-5	evaluate the psychological benefits of meditation, ways to develop Presence, benefits of doing in regular life, Scientific Facts about Mindfulness and anger styles.	K5

Unit I Meditation

Meditation — Major types of meditations: Zazen- Mindfulness- Vipasana- Yoga- Self-inquiry- Listening- Health benefits of meditation: physical- psychological- spiritual–Tips for better meditation.

Exercises: Practicing Zazen meditation – Self-enquiry meditation exercises

Unit II Self-Awareness

Awareness – Self-awareness – Importance of self-awareness –Difference between Awareness and Concentration – Power of concentration – Levels of concentration – How to increase concentration? –Ways to develop your presence

Exercises: Body Scan exercise

Unit III Yoga

Different types of yoga- Pranayama – Surya namaskara– Basic asanas for healthy life- Pranam asana- Hasta Uttan Asana- Pada Hasta Asana- Adhomukha Svanasana - Danda Asana -Vajra Asana- Padmasana- Parvat Asana- Utthita Padasana- Navasana- Bujang Asana- Dhanur Asana- Savasana

Exercises: Practicing basic Asanas – Doing Sun Salutation

Unit IV Mindfulness

Definition of mindfulness – Three components of mindfulness– Mindfulness and Brainwave patterns – Myths about mindfulness – Scientific Facts about mindfulness – Formal and Informal methods method to practice mindfulness

Exercises: Practice Mindful Walking –Practice Mindful Talking

Unit V Heartfulness

Attitude to life – Power of positive attitude– Techniques to develop positive attitude– Positive vs negative people – Forms of negative attitude – Heartfulness – Managing fear: Basic 5 fears- way's to overcome fear–Handling anger: Anger styles- Tips to tame anger

Exercises: Practice Loving-Kindness meditation– Doing compassionate actions.

Recommended Texts

1. Rev. Dr. Francis Thamburaj, *Meditation and Yoga for Holistic Wellbeing, Grace Publication, Trichy, 2019.*

Reference Books

1. Emily Lysandra, Yoga fitness for Weight Loss: Yoga for beginners, Yoga Sequencing, Weight loss, Calm Your Mind, Attain Inner Peace Kindle Edition, 2020.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	1	1	1	3	3	1	1	1	3	3
CO-2	1	1	1	3	3	1	1	1	3	3
CO-3	1	1	1	3	3	1	1	1	3	3
CO-4	1	1	1	3	3	1	1	1	3	3
CO-5	1	1	1	3	3	1	1	1	3	3
Ave.	1	1	1	3	3	1	1	1	3	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Semester III	
Self-Study **Chemistry for competitive exams**	
Code : 23UCHSS1 (Compulsory)	**Credit: +2**

Objective

This course aims at providing an overall view of the

- Purification of organic compounds and detection of elements
- Atomic theory and atomic structures
- Periodicity of properties
- Properties of ionic and covalent compounds`

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	acquire knowledge in periodic table, periodic properties, atomic structure, chemical bonding and amino acids	K1
CO-2	indicate different anions in unknown substance, write electronic configurations, explain periodic properties and chemical properties of amino acids	K2
CO-3	classify elements in periodic table, amino acids, proteins and drugs and purify organic compounds	K3
CO-4	investigate the presence of carbon, hydrogen, analyze the physiological action of vitamins, distinguish various allotropes and compare metals and non metals.	K4
CO-5	evaluate the presence of ions, halogens, proteins and metallic character of elements.	K5

Unit I Purity Analysis and Applications of Organic Compounds

Organic chemistry - Sources of organic compounds. Purification - of organic compounds - Criteria of purity-Qualitative analysis - detection of elements - Detection of nitrogen- sulphur- halogens phosphorus - Test for nitrogen – Test for Sulphur - Test for halogens – Beilstein test for halogen - Test for phosphorus- Quantitative analysis - Estimation of carbon and hydrogen - Estimation of nitrogen - Detection of metals- Separation of mixture into components – Polymers – Plastics – Rubber - Synthetic fibres.

Unit II Structure of Atoms

Atoms – Definition – Dalton's atomic theory - sub atomic particles - charges of sub – atomic particles discoveries of subatomic particles - atomic and mass number - isotopes – symbols for elements - principles governing filling up of electrons in the orbitals – Electronic configurations of first twenty elements. Rutherford; J.J Thomson and Bohr's atomic models – valency - formula and naming of compounds - Molecular mass and mole concept.

Unit III Classification of Elements and Periodicity of Properties

Classification of elements Doberiner- Newlands- Mendeleev and modern Periodic tables - Groups & Periods - classifications of elements into s, p, d and f block with examples periodicity of properties - metallic character- atomic - ionic radii-. ionization potential energy- electron affinity and electronegativity.

Unit IV Chemical Bonding and Non - Metals

Need for the Chemical bond formation - introduction to ionic bond- covalent bond- coordinate bond and metallic bond - ionic bond formation - definition- and explanation using NaCl - covalent bond - definition and explanation using H_2, O_2, N_2, CH_4, Properties of ionic and covalent compounds Noble gases and their applications - Halogens and their applications preparation and uses of hydrogen- phosphorus and Sulphur - Differences between diamond and graphite - Fullerenes.

Unit V Biochemistry

Amino acids – Classification – Properties - Zwitter ion structure- Isoelectric point – Chemical properties - Synthesis of amino acids – Proteins - Importance of proteins - Composition of proteins - Classification of proteins - Tests for proteins - Properties of proteins – Drugs - Therapeutic index - Sulpha drugs – Arsenicals - Antipyretics and analgesics – Antimalarials – Antibiotics - Vitamins – Definition – Classification – Provitamins - Physiological action - Vitamin A- Vitamin. A2-Vitamin D- Vitamin E- Vitamin B-complex- Vitamin C – Hormones - Enzymes - Nucleic acids - Viruses - Metal ions in biological systems.

References Books

1. Arun Bahl and Bahl B. S. *Advanced Organic Chemistry*, S. Chand and Company Ltd., Reprint, 2017.
2. Puri B. R, Sharma L. R, Kalia. K. C. *Principles of Inorganic Chemistry* Paperback – Vishal Publishing Co. 33rd edition, December 2020.
3. Sathyanarayana U and Chakrapani U. *Essentials of Biochemistry*. Elsevier, 2021.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	2	3	2	3	2	3	1	3
CO-2	3	3	2	3	2	3	2	3	1	3
CO-3	3	3	2	3	3	3	2	3	1	3
CO-4	3	3	2	3	3	3	3	3	2	3
CO-5	3	3	2	3	3	3	3	3	2	3
Ave.	3	3	2	3	2.6	3	2.4	3	1.4	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER – IV			
Part-I Tamil Paper - 4 சங்க இலக்கியங்கள் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, நாடகம்			
Course Code 23ULTA41	**Hrs / Week:6**	**Hrs / Semester: 90**	**Credits: 4**

நோக்கங்கள்

	Learning Objectives
1	சங்க இலக்கியத்தின் சிறப்பையும் நாடகம் என்னும் இலக்கிய வகையின் தன்மைமையையும், அகத்திணை புறத்திணை இலக்கணங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்
2	இலக்கியங்களின் சிறப்பினை உணர்த்துதல். சங்கம் வைத்துத் தமிழாய்ந்த மன்னர், புலவர், மக்கள் இவர்களின் வாழ்வியல் அறங்களைக் கண்டறிவர்.
3	மொழியைப் பிழையின்றி பேசவும் எழுதவும் பயன்படுகிறது. படைப்பாற்றல் திறனை வளர்க்க உதவுகிறது.
4	பழந்தமிழர் வாழ்வியல் முறைகளை கற்று பயனடைய உதவுகிறது பண்பாட்டுச் சிறப்பினை மொழியின் வழி அறிந்து தம் வாழ்வில் கடைப்பிடிக்க வழிகாட்டுகிறது.
5	தமிழ் இலக்கியம் சார்ந்த போட்டித்தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்

பாடத்திட்டத்தின் பயன்கள்

CO.No.	**இப்பாடத்தைக் கற்பதால் மாணவிகள் பின்வரும் பயனை அடைவர்**	**Cognitive Level**
CO-1	சங்க இலக்கியத்தில் காணப்பெறும் வாழ்வியல் சிந்தனைகளை அறிந்து கொள்வர்	K1
CO-2	தமிழின் தொன்மையையும் செம்மொழித் தகுதியையும் அறிந்து கொள்ளுதல்	K2
CO-3	நாடக இலக்கியம் மூலம் நடிப்பாற்றலையும், கலைத்தன்மையையும், படைப்பாற்றலையும் வளர்த்தல்	K4
CO-4	பழந்தமிழர் வாழ்வியல் முறைகளை கற்று பயனடைய உதவுகிறது.	K4
CO-5	போட்டித் தேர்வுகளுக்குப் பயன்படும் வகையில் படைப்பாக்கத் திறனை வளர்த்து வேலைவாய்ப்பினையும் பெறுவர்.	K5

அலகு – 1 **(18 மணி நேரம்)**

I. எட்டுத்தொகை

1. நற்றிணை – பாடல்கள் 10, 14, 16
2. குறுந்தொகை – பாடல்கள் 16, 17, 19, 20, 25, 29, 38, 440
3. கலித்தொகை – பாடல்கள் 38, 51
4. அகநானூறு - பாடல்கள் 15, 33
5. புறநானூறு - பாடல்கள் 37, 86, 112
6. பரிபாடல் - பாடல் - 55

அலகு – 2 **(18 மணி நேரம்)**

பத்துப்பாட்டு – நெடுநல்வாடை – நக்கீரர்

அலகு - 3 **(18 மணி நேரம்)**

இலக்கணம்

பா வகைகள்

1. ஆசிரியப்பா, வெண்பா பொது இலக்கணம்

அணி இலக்கணம்

1. உவமை அணி
2. உருவக அணி
3. வேற்றுமை அணி
4. வஞ்சப் புகழ்ச்சி அணி
5. சிலேடை அணி
6. தற்குறிப்பேற்றணி

அலகு - 4

இலக்கிய வரலாறு **(18 மணி நேரம்)**

1. எட்டுத்தொகை
2. பத்துப் பாட்டு
3. சங்க இலக்கியச் சிறப்பியல்புகள்

அலகு - 5 **(18 மணி நேரம்)**

நாடகம் : சபாபதி - பம்மல் சம்பந்த முதலியார்

துணை நின்ற நூல்கள்

1. பத்துப்பாட்டு - பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

2. எட்டுத்தொகை - பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

பார்வை நூல்கள்

1. நன்னூல் - பவணந்தி முனிவர்
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.
2. தமிழ் இலக்கிய வரலாறு - தமிழ்த்துறை தொகுப்பு

தூய மரியன்னை கல்லூரி (தன்னாட்சி),
தூத்துக்குடி.
3. பத்துப்பாட்டு - முனைவர் நாகராசன் (உரையாசிரியர்)
நியூ செஞ்சுரி புக் ஹவுஸ் (பி) லிட்
41, அம்பத்தூர்
சென்னை – 98.
4. பத்துப்பாட்டு - முனைவர் கு.வெ. பால சுப்பிரமணியன்(உரையாசிரியர்)
நியூ செஞ்சுரி புக் ஹவுஸ் (பி) லிட்
41, அம்பத்தூர்
சென்னை – 98.

இணைய ஆதாரங்கள்

1. Tamil Heritage Foundation- www.tamilheritage.org <http://www.tamilheritage.org>
2. Tamil virtual University Library- www.tamilvu.org/ library http://www.virtualvu.org/library
3. Project Madurai - www.projectmadurai.org.
4. Chennai Library- www.chennailibrary.com <http://www.chennailibrary.com>.
5. Tamil Universal Digital Library- www.ulib.prg <http://www.ulib.prg>.
6. Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com
7. Tamil Books on line- books.tamil cube.com
8. Catalogue of the Tamil books in the Library of British Congress archive.org
9. Tamil novels on line - books.tamilcube.com

Course Outcomes (PO)	Programme Specific Outcomes (PSO)				
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	3
CO-2	2	3	2	1	1
CO-3	3	2	2	2	3
CO-4	1	3	3	2	2
CO-5	3	1	2	2	3
Ave	2.4	2.1	2.3	1.8	2.4

Maping	**<40%**	**≥ 40%and<70%**	**≥70%**
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER – IV			
Part I French	**French Literature and Grammar II**		
Course Code: 23ULFA41/ 23ULFB41	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Learning Objectives:

- To explore the French Literature.
- To appreciate the values imbibed in the literary texts
- To develop an interest in the French literature that will encourage her to pursue higher studies in French.
- To analyse and interpret verbal expressions of cause, effect, purpose, and opposition in French

Course Outcomes		
Course Outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO-1	comprehend the French literary background and inculcate the values imparted through the literary texts	K1
CO-2	interpret a literary text, with the perspective of analyzing the content and manner of writing	K2
CO-3	imbibe the basic grammatical structures of the language to demonstrate knowledge of various expressions used to convey opinion, emotions, cause, effect, purpose, and hypothesis in French	K3
CO-4	analyze simple literary texts to acquire literary knowledge and enhance aesthetic perception	K4
CO-5	evaluate and reflect on the humanistic value by reflecting upon the author's ideas and transform her own personality	K5

SEMESTER – IV			
Part I French	**French Literature and Grammar II**		
Course Code: 23ULFA41/ 23ULFB41	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Unit I – XVIII^{e} siècle

1.1 – Candide : il faut cultiver notre jardin - Voltaire
1.2 – Le Barbier de Séville - Beaumarchais
1.3 – Les pronoms relatifs

Unit II – XIX^{e} siècle

2.1 – Le lac - Alphonse de Lamartine
2.2 – La mare au diable (extrait) - Georges Sand
2.3 – Le présent du conditionnel

Unit III – XX^{e} siècle

3.1 – Pour faire le portrait d'un oiseau - Jacques Prévert
3.2 – Mémoires d'une jeune fille rangée (extrait)- Simone de Beauvoir
3.3 – Le subjonctif présent

Unit IV Francophonie - Belge

4.1 – Monsieur friquet – Camille Lemonnier
4.2 – Le discours indirect
4.3 – La comparaison

Unit V – Francophonie – Afrique noire

5.1 – Le Mandat (La carte d'identité) - Ousmane Sembène
5.2 – L'expression de la cause et conséquence
5.3 - L'expression de but et opposition

Textbook:

- Textes complié par le département de français
- Clémence Fafa, Yves Loiseau, Violette Petitmengin, *Grammaire Essentielle Du Français A1*, Didier, 2018

Books, Journals and Learning Resources

- K. Madanagobalane, N.C.Mirakamal. *Le Francais par les Textes*. Chennai : Samhita Publications, 2019.
- Ludivine Glaud, Muriel Lannier, Yves Loiseau, *Grammaire Essentielle Du Français A1 A2*, Didier, 2015
- Blondeau Nicole, Allouache Ferroud jà, Ne Marie-Françoise. *Littérature Progressive du Français*. Paris : CLE International, 2004.

- Akyuz Anne, Bazelle-Shahmaei Bernadette, Bonenfant Joelle, Gliemann Marie-Francoise. *Les 500 exercices de grammaire*. Paris : Hachette livre, 2005
- Grégoire Maria. *Grammaire Progressive du français*. Paris : CLE International, 2002.
- Sirejols Evelyne, Tempesta Giovanna,Grammaire. *Le Nouvel Entrainez-vous avec 450 Nouveaux Exercices.* Paris : CLE International, 2002
- www.francaisfacile.com/exercices/
- www.bonjourdefrance.com
- https://www.conte-moi.net/node/120

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	1	3	2	2	1	2	3	3
CO-2	3	2	2	2	2	2	2	3	3	3
CO-3	3	3	1	2	2	3	3	2	2	3
CO-4	3	3	2	2	1	1	2	2	3	3
CO-5	2	1	2	3	3	2	2	3	3	3
Ave.	2.8	2.2	1.6	2.4	2	2	2	2.4	2.8	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER – IV			
Part II English	**Poetry, Prose, Extensive Reading and Communicative English - IV**		
Course Code: 23UGEN41	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits: 3**

Objectives:

- To enable the learners to experience the aesthetics of literary works.
- To make them use English effectively for academic purpose.
- To develop interest in the appreciation of Literature.
- To develop and integrate the use of LSRW skills.

Course Outcomes:

CO. No.	Upon completion of the course, the students will be able to	PSO Addressed	K Level
CO -1	identify and comprehend the general themes of the given works.	1,2	1
CO – 2	explain the text within their historical and cultural contexts.	1,2,3	2
CO – 3	present scholarly conversation and show their capabilities in literary competitions.	3	3
CO – 4	examine their educational and career goals.	2,4	4
CO – 5	test their understanding level in the literary development.	5	5

SEMESTER – IV			
Part II English	**Poetry, Prose, Extensive Reading and Communicative English - IV**		
Course Code: 23UGEN41	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Unit I – Poems

Lord Byron (1788 – 1824) : The Darkness
Robert Frost (1874 – 1963) : Home Burial
John Masefield (1878 -1967) : Laugh and Be Merry
Edgar A. Guest (1881-1959) : Don't Quit

Unit II –Prose

R.K. Narayan (1906 – 2001) : An Astrologer's Day
Stephen Leacock (1869- 1944) : How to be a Doctor

Unit III – Scenes from Literature

Christopher Marlowe (1564-1503) : The Parade of Seven Deadly Sins (Act 2 Scene 3 in *Doctor Faustus)*
William Shakespeare (1564- 1616): *Julius Caesar* – Assassination Scene (Act III – Scene I)

Unit IV – Grammar

Synthesis of Sentences
Direct and Indirect Speech

Unit V – Communication Skills

Narrative Report
Newspaper Report

Reference Books

1. Malathi, *Functional English*. New Century Book House (P) Ltd., 2007.
2. Joseph, K.V. *A Text book of English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited.

Web Resources

http:/www.gradesaver.com/George-orwell-essays/study/summary
https://americanenglish.state.gov/files/ae/resource_files/a-retrieved-reformation.pdf The Quality of Mercy, https://poemana1ysis.com
https://learnodo-newtonic.com/famous-indian-poem

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO- 5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	3	2	3	2	3	2	2
CO-2	3	2	2	3	2	3	2	2	3	2
CO-3	2	3	2	3	3	2	3	2	2	3
CO-4	3	2	2	3	3	3	2	2	2	3
CO-5	2	2	3	3	3	2	2	3	2	3
Ave.	2.6	2.2	2.4	3	2.6	2.6	2.2	2.4	2.2	2.6

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

Semester IV			
Part III	**Core IV General Chemistry IV**		
Code: 23UCHC41	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 5**

Objectives

This course aims to provide a comprehensive knowledge on

- The concepts of adsorption and catalysis
- Application of nuclear energy
- Synthesis and application of colloids in various fields
- The organic chemistry of ethers, carboxylic acids, aldehydes and ketones

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	explain the terms and processes in thermodynamics; nuclear reactions, the fundamental organic chemistry of acids and ethers.	K1
CO-2	discuss the various laws of thermodynamics, nuclear energy, properties of colloids and nomenclature of organic functional groups.	K2
CO-3	investigate the application of chemistry laws of thermodynamics to heat engine, radioactivity and the mechanism of organic reactions.	K3
CO-4	apply laws of thermodynamics to heat capacity measurement, discuss the chemistry of ethers, epoxides and carbonyl compounds and analyze the applications of radioactive elements	K4
CO-5	evaluate thermo chemical calculations, the chemistry and named reactions related to carboxylic acids, active methylene compounds and magnetic and nuclear waste management	K5

UNIT I Surface Chemistry

Adsorption – Chemical and physical adsorption - their general characteristics- distinction between them - different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory (derivation not required)- kinetics of enzyme catalysed reaction – Michaelis - Menten and Briggs - Haldene equation – Lineweaver - Burk plot – inhibition – reversible – competitive- noncompetitive and uncompetitive (no derivation of rate equations)

Catalysis – general characteristics of catalytic reactions- auto catalysis- promoters- negative catalysis- poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis. Heterogenous catalysis

UNIT II Colloids

Types of Colloids - Characteristics of Colloids (Lyophilic and Lyophobic sols)- Preparation of Sols- Dispersion methods (Bredig's Arc Method- Peptisation) aggregation methods -(double decomposition- reduction-oxidation-hydrolysis-change of solvent)- purification of sols-dialysis-electrodialysis- Properties of Sols- Optical properties (Tyndall effect) - Electrical properties (Brownian movement) - Electrical double layer-Electro Kinetic properties- Electro-osmosis-Electrophoresis- Coagulation or precipitation- protective action of sols gold number- Hofmeister series- Stability of sols- associated colloids- Cleansing Action of Soaps and Detergents -Emulsions-types and examples-Gels-types—preparation-properties of Gels - Applications of colloids medicine-thixotropic paints- Clarification of Municipal water-Formation of Delta- Artificial Kidney machine- Adsorption indicators

UNIT III Nuclear Chemistry

Introduction- fundamentals of subatomic particles - difference between thermal and nuclear reactions-Half-life period; Fajan–Soddy group displacement law- Geiger–Nattal rule; isotopes- isobars- isotones- mirror nuclei- iso diaphers-nuclear isomerism- radioactive decay series- magic numbers- units – Curie- Rutherford-Roentgen- nuclear stability - neutron- proton ratio- binding energy- packing fraction- mass defect- Simple calculations involving mass defect and B.E. - decay constant and $t_{1/2}$ and radioactive series.

Isotopes – tracers – radiocarbon dating – rock dating. (Problems to be worked out)

Nuclear energy; nuclear fission and fusion – Applications - Nuclear reactors- Atom bomb- hydrogen bomb - stellar energy- major nuclear reactors in India- radiation hazards- disposal of radioactive waste and safety measures-Applications of radioactive isotopes.

UNIT IV Reactivity of Organic Compounds I

Ethers, Thio ethers and Epoxides

General methods of preparations - reactions involving cleavage of C-O linkages - alkyl group and ethereal oxygen -

Zeisel's method of estimation of methoxy group.

Aldehydes and Ketones

Structure and reactivity of aliphatic and aromatic aldehydes and ketones- general methods of preparation and physical properties- Nucleophilic addition reactions- base catalysed reactions with mechanism- Aldol- Cannizzaro's reaction- Perkin reaction- Benzoin condensation-Haloform reaction- Knoevenagel reaction- Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones- Reduction- Clemmensen reduction- Wolf - Kishner reduction- Meerwein – Pondorf Verley reduction- reduction with $LiAlH_4$ and $NaBH_4$. Addition reactions of unsaturated carbonyl compounds- Michael addition.

UNIT V Reactivity of Organic Compounds II

Carboxylic Acids: Structure- preparation and reactions of aliphatic and aromatic monocarboxylic acids- Physical properties- acidic nature- effect of substituent on acidic strength- HVZ reaction- Claisen ester condensation- Bouveault Blanc reduction - decarboxylation- Hunsdiecker reaction- Formic acid-reducing property.

Reactions of dicarboxylic acids - Blanc rules - unsaturated acids.

Carboxy acid Derivatives: Preparations of aliphatic and aromatic acid chlorides- esters- amides and anhydrides- Nucleophilic substitution reaction at the acyl carbon of acyl halide- anhydride- ester- amide- Schottan- Baumann reaction. Dieckmann and Reformatsky reactions- Hofmann bromamide degradation and Curtius rearrangement.

Active methylene compounds: Keto – enol tautomerism- Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate

Recommended Text

1. B. R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co., thirty three edition, 1992.
2. K. L. Kapoor, *A Textbook of Physical chemistry*, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009.
3. P. L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & Sons, twentieth edition, 2006.
4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.
5. S. M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
6. Arun Bahl and Bahl B. S. *Advanced Organic Chemistry*, S. Chand and Company Ltd., Reprint, 2017.

Reference Books

1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*, 4th ed.; The Macmillan Company: Newyork, 1972.

2. Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS William Heinemann: London, 1991.
3. Gurudeep Raj, *Advanced Inorganic Chemistry*, 26th ed.; Goel Publishing House: Meerut, 2001.
4. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford University, Press: New York, 2014.
5. Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity,* 4th ed.; Addison Wesley Publishing Company: India, 1993.

Website and e-learning source

MOOC components

https://nptel.ac.in/courses/112102255 - Thermodynamics

https://nptel.ac.in/courses/104101136 - Advanced transition metal chemistry

Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	2	2	3	2	2	1	3
CO-2	2	3	2	3	2	3	2	2	1	3
CO-3	3	3	2	2	3	3	3	3	1	3
CO-4	3	3	2	3	3	3	3	3	1	3
CO-5	3	2	2	3	3	3	3	3	1	3
Ave.	2.8	2.8	2	2.6	2.6	3	2.6	2.6	1	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Semester IV			
Part III	**Semimicro Qualitative Analysis of Inorganic Mixture**		
Code: 23UCHCR4	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives

This course aims to provide a comprehensive knowledge on

- Developing the skill on systematic analysis of mixture of salts.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	acquire knowledge on the systematic analysis of mixture of salts.	K1
CO-2	identify the cations and anions in the unknown substance.	K2
CO-3	apply the identification the cations and anions in the soil and water and to test the quality of water.	K3
CO-4	assess the role of common ion effect and solubility product in precipitation	K4
CO-5	evaluate quality of various samples by determining the anion and cations in them	K5

- Systematic qualitative analysis of a mixture containing two anions and two cations. One of the anions should be an interfering radical which should be eliminated. The two cations should be of different groups.
- Principles of flame testing – concept of solubility and solubility product – concept of pH and Buffer action – common ion effect - theory of testing anions (Simple and interfering) – Principle of grouping of cations –Theory of testing cations.

The combination of mixture containing two halides, (sulphates along with lead, barium, strontium and calcium), (oxalate and carbonate) & (one oxidizing and one reducing group), should be avoided.

Anions:

(i) Carbonate (ii) Sulphide (iii) Sulphate (iv) Nitrate (v) Borate (vi) Oxalate (vii) Fluoride (viii) Chromate (ix) Phosphate

Cations:

(i) Lead (ii) Copper (iii) Bismuth (iv) Cadmium (v) Antimony (vi) Nickel (vii) Manganese (ix) Zinc (x) Barium (xi) Strontium (xii) Calcium (xiii) Magnesium (xiv) Ammonium.

Reference Books:

1. V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.

Website and e-learning source

https://www.vlab.co.in/broad-area-chemical-science

Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	2	2	1	3	2	2	1	2
CO-2	3	2	2	2	1	3	2	2	1	3
CO-3	3	2	2	2	1	3	2	2	1	3
CO-4	3	2	2	2	1	3	2	2	1	3
CO-5	3	2	3	3	2	3	2	3	1	3
Ave.	3	2	2.2	2.2	1.2	3	2	2.2	1	2.8

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER IV			
Generic Elective IV- Physics II (II B.Sc., Chemistry)			
Course Code : 23UPHE41	**Hrs/Week: 4**	**Hrs/ Semester: 60**	**Credits: 4**

Objectives:

- To offer knowledge in the physical phenomena such as electrostatics, electromagnetism, relativity, optics and energy physics through the systematic study of theory and experiments

Course outcomes:

CO.No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Describe the fundamentals of interference, atoms models, nuclear models, frame of reference and semiconductors.	K1
CO-2	Discuss polarisation, quantum number, radioactivity, special theory of relativity and characteristics of diodes.	K2
CO-3	Apply optical activity in sugar industries, photoelectric effect in optoelectronic device, implement the safety of reactors, apply gravitational waves in theoretical sciences and semiconductor physics at EV charging station.	K3
CO-4	Examine the colours of thin films, Pauli's exclusion principle, magic numbers and shell model, mass-energy equivalence and full wave bridge rectifier.	K4
CO-5	Calculate the wavelength using diffraction grating, evaluate the frequency using Einstein's photoelectric equation, energy released in fission, length contraction using Lorentz transformation equations and the breakdown voltage of zener diode.	K5

SEMESTER IV			
Generic Elective IV- Physics II (II B.Sc., Chemistry)			
Course Code: 23UPHE41	**Hrs/Week: 4**	**Hrs/ Semester: 60**	**Credits: 4**

Unit I: Electrostatics

Coulomb's law – Electric field and field intensity – Electric field due to point charge – Electric dipole – Electric flux – Gauss law – Applications – Electric field due to a charged conducting sphere (point inside and point outside) – Uniformly charged cylinder (line charge) – Electric potential – Potential difference – Relation connecting electric field and electric potential at a point – Equipotential surface.

Unit II: Electromagnetism

Faraday's laws of induction – Induced current and charge – Selfinduction – Self inductance of toroidal solenoid – Determination of self inductance using Rayleigh method – Mutual inductance – Coefficient of coupling – Determination of mutual inductance using B.G.

Unit III: Nuclear Physics

Classification of Nucleus – Nuclear constituents – Properties of nucleus – Expression for magnetic moment of nucleus– Packing fraction – Mass defect and binding energy – Binding energy curve – Nuclear forces – Natural radioactivity – Laws of radioactive disintegration – The Half-life period – The mean life period .

Unit IV: Relativity and Wave mechanics

Frame of reference – Galilean transformation – Postulates – Lorentz transformation –De Broglie's theory of matter waves – De Broglie wavelength – Wave function –Postulates of quantum mechanics – Schrodinger wave equation – Time dependent form.

Unit V: Optics

Interference – interference in thin films –colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light vs sound – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity – application in sugar industries

Text Books

1. A. Ubald Raj & G. Jose Robin, Electromagnetism and Plasma Physics, Indra Publications 1998.
2. A. Ubald Raj & G. Jose Robin, Allied Physics II, Indra Publications 2016.
3. R. Murugeshan, Modern Physics, S. Chand & Co. 2011.
4. Brijlal and N. Subramanyam (2002), Text book of Optics, S. Chand & Co, New Delhi.

Referencebooks

1. G. D. Rai, Solar energy Utilization, Khanna Publishers, V edition, 7th reprint 2008.
2. Brijlal N. Subramanian, Electricity & Magnetism, Ratan Prakashan Mandir, 14th revised edition, (1985).
3. K. K. Tewari, Electricity and magnetism –Published by Sultan Chand & Co, Reprint-2nd edition 1994.
4. Milman and Taub, Integrated Electronics – International student edition,(TMH)
5. D.R.Khanna and H.R. Gulati (1979).Optics, S.Chand &Co.Ltd.,New Delhi.

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes (CO) for each course with program outcomes (PO) & Programme Specific Outcomes (PSO) in the 3-point scale of HIGH (3, ≥ 70%), MEDIUM (2, ≥ 40% and < 70%) and LOW (1,<40%).

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	2	2	1	1	1	1	1	1	1	1
CO-2	3	2	1	1	1	2	1	1	2	2
CO-3	3	3	2	3	1	3	3	2	3	2
CO-4	3	3	2	1	1	3	3	3	3	3
CO-5	3	3	2	1	1	3	2	3	3	3
Ave.	2.8	2.6	1.6	1.4	1	2.4	2	2	2.4	2.2

SEMESTER- IV			
Generic Elective Practical IV- Physics Practical II (II B.Sc., Chemistry)			
Course Code : 23UPHER4	**Hrs/Week: 2**	**Hrs/ Semester: 30**	**Credits: 1**

Objectives:

- Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results.

Any SEVEN

1. Radius of curvature of lens by forming Newton's rings
2. Thickness of a wire using air wedge
3. Wavelength of mercury lines using spectrometer and grating
4. Refractive index of material of the lens by minimum deviation
5. Refractive index of liquid using liquid prism
6. Determination of AC frequency using sonometer
7. Thermal conductivity of poor conductor using Lee's disc
8. Characterisation of Zener diode
9. Construction of AND, OR, NOT gates using diodes and transistor
10. NOR gate as a universal building block

SEMESTER IV			
NME II	**Industrial Chemistry**		
Course Code: 23UCHN41	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives

This course aims to provide a comprehensive knowledge on

- The constituents of petrochemicals.
- The importance of reclaimed rubber.
- The analysis of fats and oils.
- The nature of artificial and natural food colorants.
- The specification and standards in quality control.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	learn how to select and design materials for industrial applications considering factors like cost, efficiency and environmental impact	K1
CO-2	gain knowledge of fundamental chemical process used in industrial settings, including reactions, separation techniques and synthesis methods	K2
CO-3	develop proficiency in utilizing analytical techniques such as titration for quality control and process monitoring	K3
CO-4	familiarize oneself with regulatory requirements and standards governing industrial chemistry, ensuring adherence to legal and safety guidelines	K4
CO-5	acquire skills in optimising chemical processes and explore methods to minimize negative impacts, promoting sustainable practices	K5

Unit I Petro Chemicals

Occurrence – composition of petroleum – Refining of petroleum – purification –cracking – types of cracking – catalytic cracking – thermal cracking – knocking and antiknocking properties – octane number – activation. Gasoline – cetane number – flash point –synthetic petrol

Unit II Rubber Industry and Fibres

Manufacture of rubber, types and properties of rubber – compounding of rubber –vulcanization – properties of vulcanized rubber– synthetic rubber – SBR rubber and Neoprene rubber – Reclaimed rubber and foam rubber –uses.

Fibres – Difference between natural and synthetic fibres

Unit III Fats, Oils and Waxes

Fats and oils – definition – physical and chemical properties – Analysis of fats and oils– Saponification value, iodine value- acid value- Reichert-Meissel value– manufacture of vanaspathi or vegetable ghee. Waxes – definition and classification.

Unit IV Food Additives

Baking soda – food colour natural and artificial – intentional food additives – acid base and their salts – antioxidants – stabilizers– bleaching – maturing agents – leavening agents – humectants and preservatives.

Unit V Food adulteration and Quality control

Food Adulteration- contamination of wheat- rice- milk- butter with clay stones- water and toxic chemicals- Detection of adultered foods by simple analytical techniques

Quality control – Specification and standards: PFA- FPO- FDA- drug licence- WHO standards- IS specification packing and label requirements- essential commodities act- consumer protection act-AGMARK- FSSAI.

Reference Books

1. Siva Sankar B. *Food processing and preservation*. New Delhi: Prentice — Hall of India Pvt. Ltd., 2002.
2. Bagavathi Sundari K. *Applied Chemistry.* Chennai: MJP Publishers, Tamil Nadu Book House, 2006.
3. Agarwal. *Natural Products Volume II (Organic)*.Meerut: Krishna Prakashan Media P. Ltd, 2015.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	1	2	1	3	2	3	2	1
CO-2	1	3	2	2	2	2	3	2	1	1
CO-3	3	1	1	2	2	3	2	3	2	3
CO-4	3	3	2	2	2	1	3	3	2	2
CO-5	1	1	3	2	1	3	1	2	2	3
Ave.	2.2	1.8	1.8	2.0	1.6	2.4	2.1	2.3	1.8	2.0

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER IV			
Part IV SEC V	**Instrumental Methods of Chemical Analysis**		
Code: 23UCHSE5	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives

The course aims at providing an overall view of the

- Operation and troubleshooting of chemical instruments.
- Fundamentals of analytical techniques and its application in the characterization of compounds.
- Theory of chromatographic separation and theory of thermo analytical techniques.
- Stoichiometry and the related concentration terms.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	apply error analysis in the calibration and use of analytical instruments, explain the instrumentation of Atomic Absorption Spectrometry, UV Visible, explain thermal analysis, separation techniques.	K1
CO-2	understand errors, atomization techniques, instrumentation of infrared spectroscopy, TGA , purification techniques.	K2
CO-3	discuss calibration plots, techniques for quantitative estimation, principles of single and double beam instrument, methods of obtaining thermograms, solvent extraction.	K3
CO-4	explain preparation of solutions, chemical interferences, fundamental laws of spectroscopy, factors affecting TGA/DTA, use of chromatographic techniques in the identification of mixtures.	K4
CO-5	speculate stoichiometric calculations, sample introduction in Atomic Absorption, parts of instrument in Spectrometry, applications of thermal analysis, Development of chromatograms and R_f value.	K5

UNIT I Qualitative and Quantitative Aspects of Analysis

S.I Units- Distinction between Mass and Weight – Moles- Millimoles- Milli equivalence- Molality- Molarity- Normality- Percentage by Weight and Volume – ppm - ppb - Density and Specific Gravity of Liquids - Stoichiometry Calculations.

Sampling- evaluation of analytical data - Errors – Types of Errors- Accuracy- Precision- Minimization of Errors- Significant Figures. Methods of Expressing Precision: Mean- Median- Average Deviation- Standard Deviation- Coefficient of Variation- Confidence Limits- Q- test- F-test- T-test - The Least Square Method for Deriving Calibration plots.

UNIT II Atomic Absorption Spectroscopy:

Basic principles of instrumentation (choice of source- monochromator- detector- choice of flame and Burner designs - Techniques of atomization and sample introduction - Techniques for the quantitative estimation of trace level of metal ions from water samples.

UNIT III UV-Visible and IR Spectroscopy

Origin of spectra - interaction of radiation with matter - fundamental laws of spectroscopy and selection rules- validity of Beer-Lambert's law.

UV-Visible Spectrometry: Basic principles- instrumentation (choice of source- monochromator and detector) for single and double beam instrument - Woodward - Fieser rule for calculation of absorption maxima of dienes and α, β unsaturated ketones (simple problems can be asked using Woodward-Fieser rule) – Applications- Quantitative analysis- Geometrical isomers.

Infrared Spectroscopy: Basic principles of instrumentation (choice of source- monochromator & detector) for single and double beam instrument; sampling techniques - Application - Hydrogen bonding.

UNIT IV Thermal Methods of Analysis

TGA and DTA- Principle- Instrumentation- methods of obtaining Thermograms- factors affecting TGA/DTA- Thermal analysis of silver nitrate- calcium oxalate and calcium acetate.

DSC- Principle- Instrumentation and applications.

UNIT V Separation and purification techniques

Classification- principle- Factors affecting - Solvent Extraction – Liquid- Liquid Extraction- Chromatography: Column- TLC- Paper- Principle- Classification- Choice of Adsorbents- Solvents- Preparation of Column- Elution Mechanism of separation: adsorption- partition & ion exchange. Development of chromatograms and R_f value - Gas and HPLC (elementary idea only)

Recommended Text

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.
2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007.edition
3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint, 2017.
4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993.
5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6thedn., Prentice Hall of India Private Ltd., New Delhi, 1993.
6. B. K. Sharma, Instrumental methods of Analysis, Goel Publishing House, Meerut, 2004.

Reference Books

1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edn, Saunders college publishing, Philadelphia, 1998.
2. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons, Educational Publishers, New Delhi, 2011.
3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004.
4. Mikes, O. & Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London.
5. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000.

Website and e-learning sources

1. http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14- final.pdf
2. http://eric.ed.gov/?id=EJ386287
3. http://www.sjsu.edu/faculty/watkins/diamag.html
4. http://www.britannica.com/EBchecked/topic/108875/separation-and-purification
5. http://www.chemistry.co.nz/stoichiometry.html

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	2	2	3	3	3	3	3
CO-2	3	3	3	2	2	3	3	3	2	3
CO-3	3	3	3	2	2	3	3	3	2	3
CO-4	3	3	3	2	2	2	2	3	2	3
CO-5	3	3	3	2	2	3	3	3	3	3
Ave.	3	3	3	2	2	3	3	3	2.4	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER IV			
SEC V	**Entrepreneurial Skills In Chemistry**		
Code: 23UACH41	**Hrs/Week: 1**	**Hrs/Sem: 15**	**Credits: 1**

Objectives

The course aims at providing training to

- Develop entrepreneur skills in students
- Prepare home essentials
- Develop start ups

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	identify adulterated food items by doing simple chemical tests, natural and synthetic anti-oxidants, iodine value-simple preparation methods of cleaning powder, Jam and sanitizer.	K1
CO-2	know the adulterants, glazing agents, Preparation of cottage cheese, extraction of oils from spices, role of MUFA preparation of candles and herbal shampoo.	K2
CO-3	educate others about adulteration, food colourants, Baking powder and baking soda, Preparation of Jam products like candles, soap, detergents, extraction of oils from flowers and role of PUFA and uses of ink.	K3
CO-4	understand contamination of food items, preservatives, leavening agents, Preparation of sanitizer shampoos, pain balm, tooth paste/powder and disinfectants in small scale, extraction methods and fats in oil and properties of ink	K4
CO-5	develop as entrepreneurs in the fields of food items and to identify the additives household products and to explain hazardous effect of additives and preparation of herbal face pack.	K5

UNIT I Food Adulteration

Food adulteration-contamination of food items with clay stones- water and toxic chemicals -Common adulterants.

Detection of adulterants in food items like coffee- tea- pepper- chili powder- turmeric powder- butter- ghee- milk- honey etc.- by simple techniques.

UNIT II Food additives

Natural and synthetic anti-oxidants- glazing agents (hazardous effect)-food colourants- Preservatives- leavening agents- Baking powder and baking soda- yeast- MSG- vinegar.

UNIT III Edible Oils

Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases - Extraction of oils from spices and flowers using Clevenger/Soxhlet.

UNIT IV Home Essentials (Hands on Experience)

Preparation of Jam- squash and Jelly and paneer.

Preparation of products like candles- washing powder- dish wash liquid- cleaning powder and disinfectants in small scale

UNIT V Small Scale Industrial Products

Preparation- properties and uses of sanitizer- herbal shampoo- Ink (black, red, blue) and herbal face pack.

Recommended Text

1. George S & Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai.
2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.

Reference Books

1. Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice), Elsevier, e Book ISBN 9087128004289, 1st Edition, 2015.

Website and e-learning source

https://www.vlab.co.in/broad-area-chemical-sciences

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	2	2	3	3	3
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER V			
Part III	**Core V Organic Chemistry I**		
Code: 23UCHC51	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 6**

Objectives

This course aims to provide an understanding of

- Stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane
- Preparation and properties of aromatic and aliphatic nitro compounds and amines
- Preparation of different dyes, food colour and additives
- Preparation and properties of five membered heterocycles like pyrrole, furan and thiophene.
- Preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	write the RS notations to chirals, conformations of ethane and butane, the nomenclature of nitrogen containing compounds, recall the colour and constituent of dyes, describe the physical properties of pyridine,	K1
CO-2	explain the optical activity, Pseudo acid character of nitroalkanes, basic nature of aromatic amines, Paal Knorr synthesis of pyrrole, substitution reactions of pyridine	K2
CO-3	compile the Conformational analysis of ethane and butane, Hofmanns' degradation reaction of aliphatic amines, food additives, general characteristics of heterocyclic compound, steps in chichibabin reaction	K3
CO-4	appraise allenes, the isomerism exhibited by aliphatic amines, uses of diazomethane the synthesis of thiophene, quinolone	K4
CO-5	evaluate the syn-anti isomerism, E/Z notations, nitro - aci nitro tautomerism, zwitter ion formation, paal knorr synthesis, Bischler -Napieralski reaction	K5

UNIT I Stereochemistry

Fischer Projection-Newmann and Sawhorse Projection formulae and their interconversions-

Geometrical isomerism: cis–trans- syn-anti isomerism- E/Z notations.

Optical Isomerism: Optical activity- specific rotation- asymmetry-enantiomers-distereoisomers- meso structures - molecules with one and two chiral centres- racemisation- methods of racemisation; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.

Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane- butane and cyclohexane

UNIT II Chemistry of Nitrogen Compounds – I

Nitroalkanes

Nomenclature- isomerism- preparation from alkyl halides- halo acids- alkanes; physical properties; reactions – reduction- halogenations- Grignard reagent- Pseudo acid character. Nitro - aci nitro tautomerism.

Aromatic nitro compounds

Nomenclature-preparation – nitration- from diazonium salts- physical properties- reactions - reduction of nitrobenzene in different medium,

Electrophilic substitution reactions-TNT.

Amines: Aliphatic amines

Nomenclature- isomerism- preparation – Hofmanns' degradation reaction-Gabriel's phthalimide synthesis-Curtius Schmidt rearrangement.

Physical properties- reactions – alkylation- acylation- carbylamine reaction-Mannich reaction- oxidation-basicity of amines.

UNIT III Chemistry of Nitrogen Compounds – II

Aromatic amines – Nomenclature- preparation – from nitro compounds- Hofmann's method- Schmidt reaction- properties - basic nature- ortho effect- reactions – alkylation- acylation- carbylamine reaction- reaction with nitrous acid- aldehydes- oxidation-Electrophilic substitution reactions- diazotization and coupling reactions- sulphanilic acid - zwitter ion formation.

Distinction between primary- secondary and tertiary amines - aliphatic and aromatic

Diazonium compounds- Diazomethane-Benzene diazonium chloride- preparations and synthetic applications.

Dyes

Theory of colour and constitution- classification based on structure and application- preparation –Martius yellow- aniline yellow- methyl orange- alizarin- indigo- malachite green.

Industry oriented content Dyes Industry- Food colour and additives

UNIT IV Heterocyclic compounds

Nomenclature and classification-General characteristics - aromatic character and reactivity.

Five-membered heterocyclic compounds

Pyrrole – preparation - from succinimide- Paal Knorr synthesis- reactions – reduction- basic character- acidic character- electrophilic substitution reactions- ring opening.

Furan – preparation from mucic acid and pentosane- reactions – hydrogenation- reaction with oxygen- Diels Alder reactions- formation of thiophene and pyrrole- Electrophilic substitution reaction. Thiophene synthesis - from acetylene- reactions –reduction-oxidation- electrophilic substitution reactions.

UNIT V Six-membered heterocyclic compounds

Pyridine – synthesis - from acetylene-Physical properties- reactions - basic character- oxidation- reduction- electrophilic substitution reactions-nucleophilic substitution- uses

Condensed ring systems

Quinoline – preparation - Skraup synthesis and Friedlander's synthesis- reactions – basic nature- reduction- oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction

Isoquinoline – preparation by the Bischler – Napieralski reaction-reduction-oxidation-electrophilic substitution.

Recommended Text

1. M.K. Jain- S. C. Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.
2. S. M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.
3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S. Chand & Company Pvt. Ltd., Multicolour edition, 2012.
4. P. L. Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
5. C. N. Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.
6. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.

Reference books

1. T. W. Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition, 2012.
2. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition,2009.

3. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006.
4. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010

Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO1	3	3	2	2	1	3	3	3	2	3
CO2	3	3	2	2	1	3	3	2	2	3
CO3	3	2	2	2	1	3	3	2	2	3
CO4	3	3	2	2	1	3	3	3	2	3
CO5	3	3	3	2	1	3	3	2	2	3
Ave	3	2.8	2	2	1	3	3	2.4	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER V			
Part III Core VI	**Inorganic Chemistry I**		
Course Code: 23UCHC52	**Hrs./Week: 5**	**Hrs/Sem: 75**	**Credits: 5**

Objectives:

This course aims at providing knowledge on

- Extraction of metals.
- Characteristics of d and f block elements.
- The reactions in non- aqueous solvents.
- The nature of inorganic polymers.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	explain Liquid NH_3 as non aqueous solvent, oxidation states of d block elements, minerals, characteristics of lanthanides and classification of inorganic polymers.	K1
CO-2	discuss Liquid SO_2 as non aqueous solvent, magnetic properties, catalytic properties, ores, separation of lanthanides and polymer containing phosphorous.	K2
CO-3	understand chemical reactions involving Liquid NH_3, catalytic properties and tendency to form complexes, process involved in separation, valency change method and polymer containing Sulphur	K3
CO-4	have an idea on advantages and disadvantages of liquid NH_3 as a solvent, – comparison of II and III transition series with I transition series, refining, applications of lanthanides and their compounds and polymer containing boron.	K4
CO-5	explicate advantages and disadvantages of liquid SO_2 as a solvent, Extraction of titanium and vanadium, furnaces and its types, comparison between lanthanides and actinides and polymer containing silicon.	K5

Unit I Reactions in non-aqueous solvents

Solvent- definition- water as a universal solvent - classification of solvents – factors affecting the solvating ability– liquid range-dielectric constant – dipole moment and viscosity.

Liquid NH_3 as non aqueous solvent-reason –auto ionisation – ammono acid and bases. Reactions – neutralization- precipitation- solvolysis- complex formation and redox reactions.

Advantages and disadvantages of liquid NH_3 as a solvent.

Liquid SO_2 as non aqueous solvent – reason. Reactions- precipitation- neutralization- solvolysis- complex formation and redox reactions. Advantages and disadvantages of liquid SO_2 as a solvent.

Unit II General Characteristics of d-block elements

Transition Elements- Electronic configuration - General periodic trend variable valency - oxidation states - stability of oxidation states - colour- magnetic properties- catalytic properties and tendency to form complexes - Comparative study of transition elements and non-transition elements – comparison of II and III transition series with I transition series - Group study of Titanium and Chromium - Extraction of titanium and vanadium.

Unit III General Principles of Extraction of Metals

Minerals and ores - different steps of metallurgy – crushing and grinding of the ore – concentration of the ore – hand picking - gravity separation (Hydraulic Washing) - electromagnetic separation – electrostatic separation – froth flotation process – leaching-calcination– roasting –difference between calcination and roasting – reduction to free metals – reduction by displacement- thermal decomposition - carbon (smelting) - heating in air- Gold Schmidt's aluminothermic process – Kroll's process - Refining of impure metals – thermal refining - distillation- liquation – vapour phase refining – Van Arkel process - Mond's process- electrolytic process- zone refining process. Types of furnaces – Fuel fired – blast- reverberatory- vertical retort and muffle –Electric furnace – Arc furnaces – types - resistance furnace.

Unit IV f- Block Elements

General characteristics of lanthanides – separation of lanthanides – precipitation – thermal reaction – fractional crystallization – complex formation – solvent extraction – valency change method – ion exchange method. Extraction of a mixture of lanthanides from monazite sand – applications of lanthanides and their compounds – lanthanide contraction – causes and consequences. General characteristics of actinides – comparison between lanthanides and actinides- extraction of Th and U. Preparation and uses of UF_6 and uranyl acetate.

Unit V Inorganic Polymers

Inorganic polymers – general properties - Classification of inorganic polymers - polymer containing phosphorous – preparation- properties and structure of polyphosphonitrilic chloride - polymer containing sulphur - preparation- properties and structure of polymeric sulphur nitride - polymer containing boron – preparation- properties- structure of borazine- substituted borazine – boron nitride and polycarbonates – polymer containing silicon - preparation- properties-

structure and uses of silicone fluids- silicone rubbers and silicon resins. Silicates – classification and structure of silicates.

Recommended Text

1. Puri B.R, Sharma L.R, Kalia K.C. *Principles of Inorganic Chemistry*. Delhi: Milestone publishers and distributors, 2019 – 2020.
2. Sathya Prakash and Madan R.D. *Advance Inorganic Chemistry*. S Chand and Co, 2019.

Reference Book

1. Wahid U Malik, Tuli G.D, Madan R.D. *Selected Topics in Inorganic Chemistry*. S. Chand & Co. Ltd., 2018.
2. Albert Cotton F, Geoffrey Wilkinson, Carlos A. Murillo, Manfred Bochmann. *Advanced Inorganic Chemistry*, John Wiley & Sons. sixth edition, 2016.
3. James E. Huheey, Ellen Keiter, Richard L. Keiter, Okhil K. Medhi. *Inorganic Chemistry- Principles of Structure and Reactivity*. Pearson India Education Services Pvt. Limited, 2020.

Level of Correlation between PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	2	2	3	3	3	2	3
CO-2	3	3	3	2	2	3	3	3	2	3
CO-3	3	3	3	2	2	3	3	3	2	3
CO-4	3	3	3	2	2	2	2	3	2	3
CO-5	3	3	3	2	2	3	3	3	2	3
Ave.	3	3	3	2	2	3	3	3	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER V			
Part III Core VII	**Physical Chemistry I**		
Code: 23UCHC53	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 5**

Objectives

The course aims at giving an overall view of the

- The various thermodynamic parameters and its applications in different physical states of the systems.
- Reaction kinetics and its applications
- Concepts of chemistry behind light and sound

Course Outcomes

CO. No.	On completion of the course the students should be able to	Cognitive Level
CO-1	explain first second and third law of thermodynamics and various statement, rate law , rate of reaction, photochemical reactions and rate law	K1
CO-2	apply the concepts of thermodynamics in explaining Joule Thomson effect, Joule Thomson coefficient, predict the rate of the reaction and order of the reaction by chemical kinetics, compare chemical and photochemical reactions	K2
CO-3	identify thermodynamic equations of state, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation photophysical process	K3
CO-4	explain molar heat capacities , partial molar quantities, theories of reaction rate, and applications including fluorimetry	K4
CO-5	explain chemical potential of a system of ideal gases, theories of reaction rate, and utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.	K5

UNIT I Thermodynamics – I

Terminology – Intensive- extensive variables- state- path functions; isolated- closed and open systems; isothermal- adiabatic- isobaric- isochoric- cyclic- reversible and irreversible processes; First law of thermodynamics –various statement- Concept and significance of heat (q)- work (w)- internal energy (E)- enthalpy (H); calculations of q, w, E and H for reversible- irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between ΔH and ΔE – molar heat capacities – definition –molar heat capacity at constant volume – molar heat capacity at constant pressure relation between heat capacities (C_p & C_v); Joule Thomson effect- Joule Thomson coefficient - inversion temperature.

Unit II Thermodynamics II

Limitations of first law of thermodynamics-Spontaneous process-Examples and criteria of spontaneity-Entropy-Second law of thermodynamics –Different statements — Entropy changes of an ideal gas and van der Waals gas with changes in temperature- volume and pressure- entropy and disorder– Entropy changes in reversible and irreversible processes – -Work function and free energy function – Variation of free energy with temperature and pressure – Gibbs Helmholtz equation – Derivation and significance – Partial molar properties – Chemical potential –Gibb's Duhem equation – Derivation and significance

Unit III Thermodynamics III

Clausius- Claypeyron equation – derivation (integral and differential forms) - significances -
application in ice skating — derivation of Van't Hoff isotherm and isochore-Concept of fugacity– fugacity of a gas in a gaseous mixture –physical significance of fugacity-Nernst heat theorem – third law of thermodynamics – statement - determination of absolute entropy of solids- liquids and gases– entropy change in chemical reactions – derivation of the Boltzmann entropy equation – residual entropy – Thermodynamic equilibrium-Zeroth law of thermodynamics.

UNIT IV Chemical Kinetics

Rate of reaction - Average and instantaneous rates- factors influencing the rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions- Rate laws - Rate constants – derivation of rate constants and characteristics for zero- first order- second and third order (equal initial concentration)- Derivation of time for half change with examples. Methods of determination of order of by Volumetry- manometry and polarimetry.

Effect of temperature on reaction rate – temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate

constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.

UNIT V Photochemistry and Sonochemistry

Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. quantum yield – validity of Einstein's law – reason for low and high quantum yield – determination of quantum yield using actinometer – flash photolysis.. Photochemical reactions – rate law – Kinetics of H_2-Cl_2, H_2-Br_2 and H_2-I_2 reactions- comparison between thermal and photochemical reactions. Photophysical processes – Photosensitisation-Jablonski diagrams-photosensitisation – explanation of fluorescence applications including fluorimetry – sensitised fluorescence and phosphorescence and its applications– luminescence–bioluminescence-thermoluminescence . chemiluminescence– and examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision

Sonochemistry – definition- principle -Cavitation-Sonoluminescence- applications-in the field of industry and medicine.

Recommended Text

1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021.
2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3. Arun Bahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co.
4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
5. J. Rajaram and J.C. Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and CO., 1986.

Reference Books

1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009.
2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985.
3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.
4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001
5. D.N.Bajpai, Advanced Physical Chemistry, S. Chand & Co., 2001

Website and e-learning source

1. https://nptel.ac.in https://swayam.gov.in
2. https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPT s/MTS_07_m.pdf
3. Thermodynamics - NPTEL https://www.youtube.com/watch?v=f0udxGcoztE Introduction to chemical equilibrium – MIT open course ware

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	2	2	1	3	2	3	2	3
CO-2	1	3	2	2	3	2	3	2	2	3
CO-3	3	2	1	2	2	3	2	2	2	3
CO-4	3	3	2	2	2	1	3	3	2	3
CO-5	1	1	3	2	2	3	1	2	2	3
Ave.	2.2	2	2	2.0	2.0	2.4	2.1	2.3	2	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER V			
Part III	**Physical Chemistry Practical I**		
Code: 23UCHCR5	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 3**

Objectives

The course aims at providing an understanding of

- The laboratory experiments in order to understand the concepts of physical changes in chemistry
- The rates of chemical reactions
- Colligative properties and adsorption isotherm

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	describe the principles and methodology for the practical work	K1
CO-2	explain the procedure, data and methodology for the practical work.	K2
CO-3	apply the principles of electrochemistry, kinetics for carrying out the practical work.	K3
CO-4	demonstrate laboratory skills for safe handling of the equipment and chemicals	K4
CO-5	calculate cell constant, molecular weight by Rast method	K5

UNIT I Chemical kinetics

1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate).

Thermochemistry

2. Determination of heat of neutralisation of a strong acid by a strong base.

UNIT II Phase diagrams

1. Simple eutectic - determination of eutectic temperature and composition of naphthalene-diphenyl system, naphthalene-p-dichlorobenzene
2. Determination of upper critical solution temperature of phenol – water system
3. Determination of concentration of sodium chloride using phenol- sodium chloride system

UNIT III Colorimetry

1. Determination of concentration of copper sulphate solution

UNIT IV Colligative property

1. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent
2. Determination of molecular weight of a salt hydrate by transition temperature method.

Unit V Adsorption

1. Verification of Freundlich isotherm for the adsorption of acetic acid on activated charcoal

Reference books:

1. Sindhu, P. S. Practicals in Physical Chemistry, Macmillan India: New Delhi, 2005.
2. Khosla, B. D. Garg, V. C.; Gulati, A.; Senior Practical Physical Chemistry, R. Chand: New Delhi, 2011.
3. Gupta, Renu, Practical Physical Chemistry, 1st Ed.; New Age International: New Delhi, 2017

Website and e-learning source

https://www.vlab.co.in/broad-area-chemical-sciences

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER V			
Core Practical VI	**BIOCHEMISTRY PRACTICAL**		
Code: 23UCHCR6	**Hrs/Week: 3**	**Hrs/Sem: 45**	**Credits: 2**

Objectives

This course aims to provide knowledge on

- Identification of organic functional groups
- Different types of organic compounds with respect to their properties.
- Determination of elements in organic compounds.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Leve
CO-1	gain an understanding of the physical state, odour, colour and solubility of the given biomolecule	K1,
CO-2	identify the presence of special element of unknown biomolecule performing a systematic analysis.	K2
CO-3	estimate the amount of biomolecule present	K3
CO-4	analyze the iodine number, acid value of oil	K4
CO-5	assess the e structure of molecules through	K5

Qualitative and Quantitative Analysis

Analysis of Simple Biomolecule

I. Qualitative analysis of carbohydrates.
II. Qualitative analysis of amino acids.
III. Colour reactions of Proteins.

Volumetric Analysis (Any 8)

1. Estimation of Glycine by formal titration.
2. Estimation of Ascorbic acid.
3. Estimation of Protein by Biuret method.
4. Determination of Saponification number of oil.
5. Determination of Acid value of oil.
6. Preparation of Buffer and Determination of its pH using pH meter.
7. Estimation of sugars in fruit juices using thin layer chromatography
8. Separation of milk protein from milk and determination of pH of milk

Course Work:

Drawing the structure of simple molecules using

1. Chemdraw
2. Chemsketch
3. Discovery Studio Viewer

Reference Books

1. Vogel's Textbook of Quantitative Chemical Analysis, 2004 sixth Edition
2. Raghupati Mukhopadhyay, Pratul Chatterjee , Advanced Practical Chemistry Books and Allied (P) Ltd. Third Edition-2007

Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER V			
Discipline Specific Elective	**Biochemistry**		
Code: 23UCHE51	**Hrs./Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Objectives

This course aims at providing knowledge on

- Relationship between biochemistry and medicine, composition of blood
- Structure and properties of amino acids, peptides, enzyme, vitamins and proteins
- Biological functions of proteins, enzymes, vitamins and hormones
- Biochemistry of nucleic acids and lipids
- Metabolism of lipids

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	explain molecular logic of living organisms, composition of blood and blood coagulation	K1
CO-2	explain synthesis and properties of amino acids, determination of structure of peptides and proteins	K2
CO-3	explain factors influencing enzyme activity and vitamins as coenzymes	K3
CO-4	explain RNA and DNA structure and functions	K4
CO-5	explain biological significance of simple and compound lipids	K5

UNIT I Logic of living organisms

Relationship of Biochemistry and Medicine. Blood - Composition of Blood- Blood Coagulation – Mechanism. Hemophilia and Sickle Cell Anaemia Maintenance of pH of Blood – Bicarbonate Buffer- Acidosis- Alkalosis.

UNIT II Lipids

Definition and classification of lipids. Types of fatty acids - saturated, unsaturated, unusual and essential fatty. acids - Triacyl glycerols - their chemistry and characterisation - saponification number - iodine number - acid number - RM value - acetyl value – Chemistry of phospholipids - lecithin - cephalin - serine- plasmalogens phosphatidyl inositols- functions of phospholipids- Sphingolipids - sphingomycin- cerebroside- ganglioside (structure and function only) Cholesterol - tests - structure - (structural elucidation not required) Biochemical functions of cholesterol.

UNIT III Amino Acids And Proteins

Structure and classification Abbreviated names (1letter and 3 letter) - Structure and importance of simple peptides like glutathione- carnosine- anserine- vasopressin-

Oxytocin- peptide antibiotics (geramicidin- bacitracin and actinomycin). Protein - biochemical importance- Structure - primary structure (one method each to identify 'C' terminal and 'N' terminal amino acids) - secondary- tertiary and quaternary structures with haemoglobin as an example - Amino acid metabolism - general pathway - removal of amino group - fate of amino group- fate of carbon skeleton.

UNIT IV Vitamins And Nucleic Acids

Structure (Elucidation not needed) - Sources - deficiency - Water soluble vitamins –Ascorbic acid (Vitamin B_{12}, C); Fat soluble vitamins – Vitamin (A,D,E,K)

Purines- pyrimidines- deoxyribose- ribose- Nucleosides - nucleotides - cyclic nucleotides - Structure and functions of DNA and different types of RNAs (m-RNase RNA, t-RNA, and r-RNA). DNase and Nucleoproteins.

UNIT V Enzymes

Enzymes Classification of enzymes – Enzyme specificity - Factors affecting enzyme reaction – Michalis - Menten theory - Inhibition of enzyme action competitive- non-competitive and uncompetitive - Coenzymes and their mechanism of action – Immobilisation of enzymes- Industrial and medical applications of enzymes.

Recommended Text

1. Bahl, B. S.; Bhal, A. *Advanced Organic Chemistry*, 3rd ed.; S. Chand:New Delhi, 2003.
2. Jain, M.K.; Sharma, S. C. *Modern Organic Chemistry*, Vishal Publications: New Delhi, 2017.
3. Shanmugam, A. *Fundamentals of Biochemistry for Medical Students*, 6th ed.; Published by the author, 1999.
4. Veerakumari, L. *Biochemistry*, 1st ed.; MJP Publications: Chennai, 2004.

5. Jain, J. L.; *Fundamentals of Biochemistry*, 2nd ed.; S. Chand: New Delhi, 1983.

Reference Books

1. Conn, E. E.; Stump, P. K. *Outline of Biochemistry*, 5th ed.; Wiley Eastern: New Delhi, 2002.
2. West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. *Text Book of Biochemistry*, 4th ed.; Macmillan: New York, 1970.
3. Lehninger, A. L. *Principles of Biochemistry*, 2nd ed.; CBS Publisher: Delhi, 1993.
4. Rastogi, S. C. *Biochemistry*, 2nd ed.; Tata McGraw-Hill: New Delhi, 2003.
5. Chatterjea, M. N.; Shinde, R. *Textbook of Medical Biochemistry*, 5th ed.; Jaypee Brothers: New Delhi, 2002.

Website and e-learning source

1. http://library.med.utah.edu/NetBiochem/nucacids.html
2. http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html
3. https://swayam.gov.in/courses/4384-biochemistry Biochemistry
4. https://onlinecourses.nptel.ac.in/noc19_cy07/preview Experimental Biochemistry

Level of Correlation between PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER V			
Discipline Specific Elective	**Industrial Chemistry**		
Code: 23UCHE52	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Objectives

This course aims at providing knowledge on

- classifications and characteristics of fuels
- preparation of cosmetics
- manufacture of sugar, paper, cement and leather and food processing
- applications of abrasives, lubricants and other industrial products
- intellectual property rights

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	summarize the properties of fuels which include petroleum, water gas, natural gas and propellants	K1
CO-2	evaluate cosmetic products, soaps, detergents.	K2
CO-3	explain manufacture of sugar, food spoilages and food additives	K3
CO-4	explain properties of abrasives, manufacture of leather and paper	K4
CO-5	explain properties and manufacture of lubricants and cement, and intellectual property rights	K5

UNIT I Fuels

Classification, characteristics of fuels. Solid fuels: coal - classification; calorific value-determination, carbonisation of coal.

Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines- antiknock agents; unleaded petrol-octane number- cetane number.

Gaseous fuel: advantages over solid and liquid fuels; water gas- producer gas- carburetted water gas - preparations - uses.

Natural gas: LPG-composition- advantages- application; gobar gas- production- composition- advantages- application. Propellants – rocket fuels (basic idea)

UNIT II Cosmetics

Skin care: powders- ingredients; creams and lotion-cleansing- moisturising- all-purpose shaving cream- sunscreen; make up preparations.

Dental care: tooth pastes – ingredients.

Hair care: shampoos-types- ingredients; conditioners-types- ingredients. Perfumes: natural-plant origin-parts of the plant used- chief constituents animal origin-amber gries- civetone and musk; synthetic-classification- esters-amylsalicylate alcohols-citronellol; terpeneols-gereniol and nerol; ketones-muskone- coumarin; aldehydes-vanillin.

Soaps and Detergents -Soaps-properties- manufacture of soap-batch process; types-transparent soap- toilet soap-powder soap and liquid soap – ingredients.

Detergents-definition- properties-cleansing action; soapless detergents- anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents.

UNIT III Sugar Industry

Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar.

Food Preservation and processing

Food spoilage – causes; Food preservation - methods – high temperature- low temperature- drying- radiation; Food additives – preservatives- flavours- colours- anti-oxidants- sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius.

UNIT IV Abrasives

Definition- characteristics- types-natural and synthetic; natural abrasives – diamond- corundum- emery- garnet- quartz – composition- uses; synthetic abrasives – carborundum- aluminium carbide- boron carbide- boron nitride- synthetic graphite – composition and uses.

Leather Industry

Structure and composition of skin- hide; Manufacture of leather – pre- tanning process – curing- liming- beating- pickling; methods of tanning- vegetable- chrome – one bath- two bath process; finishing.

Paper Industry

Manufacture of pulp - mechanical- chemical processes; sulphate pulp- rag pulp; manufacture of paper- beating- refining- filling- sizing- colouring- calendaring; cardboard.

UNIT V

Lubricants Definition- classification-liquid- semi-solid- solid and synthetic; properties-viscosity index- flash point- cloud point- pour point- aniline point and drop point; greases- properties- types; cutting fluids- selection of lubricants.

Cement Industry

Cement – types- raw materials; manufacture-wet process- constituent of cement- setting of cement; properties of cement-quality- setting time- soundness- strength; mortar- concrete- RCC; curing and decay of concrete.

Intellectual Property Rights

Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty- Non obviousness- Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks- logos- brand names- signatures- symbols and service marks

Recommended Text

1. Sharma, B.K. *Industrial Chemistry*, 9th ed.; Goel Publishing House: Meerut, 1998.
2. Wilkinson, J.B.E. Moore, R.J. *Harry's Cosmeticology*, 7th ed.; Chemical Publishers: New York, 1982.
3. Alex V. Ramani, *Food Chemistry,* MJP publishers: Chennai, 2009.
4. Jayashree Ghosh, *Applied Chemsitry*, S. Chand: New Delhi, 2006.
5. Srilakshmi, B. *Food Science*, 4th ed.; New Age International Publication, 2005.

Reference Books

1. Jain, P.C.; Jain, M. *Engineering Chemistry*, 16th ed.; Dhanapet Rai:
2. Delhi, 1992
3. George Howard, *Principles and Practice of Perfumes and Cosmetics*, Stanley Therones, Cheltenham: UK, 1987.
4. Thankamma Jacob, *Foods, Drugs and Cosmetics - A Consumer Guide*, Macmillan: London, 1997.
5. ShankuntalaManay, N.; Shadaksharaswamy, M. *Food Facts and Principles*, 3rd ed.; New Age Publication, 2008.
6. Neeraj Pandey, KhushdeepDharni, *Intellectual Property Rights*, PHI Learning, 2014.

Level of Correlation between PO'S, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	33	3	3	2	2	3	3	3	2	3
CO-2	3	3	3	2	2	3	3	3	2	3
CO-3	3	3	3	2	2	3	3	3	2	3
CO-4	3	3	3	2	2	3	3	3	2	3
CO-5	3	3	3	2	2	3	3	3	2	3
Ave.	3.0	3.0	3.0	2.0	2.0	3.0	3.0	3.0	2.0	3.0

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER V		
Part IV	**Applied Chemistry**	**Self Study**
Course Code :23UCHSS2 (Optional)	**Credit : +2**	

Objectives

This course aims at providing knowledge on

- different types of water
- manufacture of soaps and detergents
- different types of special milks
- chemical nature of perfumes and pigments
- the nature and composition of paints and varnishes

Course outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	acquire knowledge in purification techniques of water, ingredients present in paints, perfumes and composition of milk	K1
CO-2	explain hardness of water, cleansing action of soaps and detergents, characteristics of paints and the uses of pigments.	K2
CO-3	classify soaps, detergents, paints, milk and know the different types of artificial flavours	K3
CO-4	investigate water quality parameters, isolate essential oils and prepare different types of milk	K4
CO-5	evaluate the quality of water, analyse the composition of milk and isolate essential oils.	K5

Unit I Water Softening Techniques

Water– water quality parameters - Hardness of water – temporary and permanent hardness, disadvantages of hard water – softening of hard water – zeolite process- demineralization process and reverse osmosis – sterilization of water for domestic use by chlorine- ozone and UV light

Unit II Soaps and Detergents

Soap – definition and types – manufacture of different types of soaps (toilet soaps, transparent soaps and liquid soaps) and their uses – cleansing action of soaps. Detergents – classification of detergents (cationic, anionic and non-ionic) – comparison of soaps and detergents.

Unit III Paint and Varnishes

Purpose of surface coating – Paint – characteristics of good paint – constituents of paints – classification of paints – fluorescent paints (traffic signal)- fire retardant paints – Varnishes – constituents and their functions. Emulsion paints.

Unit IV Pigments and Perfumes

Pigments – Definition – Examples – colours imparted by the pigments and their uses(lithopone, titanium dioxide, ultramarine blue, Red lead, chrome green) Perfumes – Ingredients of perfumes- Isolation of essential oils – Artificial flavours – apple- grape-banana- pineapple- jackfruit (Naming of a few compounds only structure not needed)

Unit V Dairy Chemistry

Milk – composition of milk - Types of milk - Special milks – sterilized milk – flavoured milk – irradiated / vitaminised milk – toned milk – condensed milk. Fermented milks – Cultured butter milk – Acidophilus milk – Yoghurt (Firm-bodied milk).

References book

1. Jayashree Ghosh. *Fundamental concepts of Applied chemistry*, New Delhi, S. Chand & company Ltd, 2006.
2. Jain P.C. and Monika Jain. *Engineering chemistry*, New Delhi: Dhanpat Rai & Sons, 2012.
3. Sharma B.K ., *Industrial Chemistry*, Meerut, Goel Publishing House, 2020.

Level of Correlation between PO'S, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	2	3	2	3	2	3	1	3
CO-2	3	3	2	3	2	3	2	3	1	3
CO-3	3	3	2	3	3	3	2	3	2	3
CO-4	3	3	2	3	3	3	3	3	2	3
CO-5	3	3	2	3	3	3	3	3	2	3
Ave.	**3**	**3**	**2**	**3**	**2.6**	**3**	**2.4**	**3**	**1.6**	**3**

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER VI			
Part III Core VIII	**Organic Chemistry II**		
Code: 23UCHC61	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 4**

Objectives

This course aims to provide knowledge on

- Classification, isolation and discussing the properties of alkaloids and terpenes
- Preparation and properties of saccharides
- Biomolecules
- Different molecular rearrangement
- Preparation and properties of organometallic compounds

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	define isoprene rule, entatiomers and diastereomers, synthetic reagent, rearrangement types, green chemistry	K1
CO-2	explain Hofmann Exhaustive Methylation, configuration of monosacharides, Frankland reagent, benzidine rearrangement, twelve principles of green chemistry	K2
CO-3	compile the structure of citral, biological importance of starch and cellulose, synthetic applications of grignard reagent, the steps involved in pinacol-pinacolone rearrangement, microwave assisted reaction in water	K3
CO-4	analyse the structure of coniine, heparin, Beckmann rearrangement, Wilkinson catalyst, atom economy	K4
CO-5	evaluate the structure of geraniol and camphor, ascending and descending of sugar series, Curtius rearrangement, oxidation of alcohols using clayfen	K5

UNIT I Alkaloids

Classification- isolation- general properties- Hofmann Exhaustive Methylation- Structure elucidation – Coniine- piperine- nicotine.

Terpenes: Classification-Isoprene rule- isolation and structural elucidation of Citral- alpha terpineol- Menthol- Geraniol and Camphor.

UNIT II Carbohydrates

Definition and Classification of Carbohydrates with examples-Relative configuration of sugars- Determination of configuration (Fischer's Proof)- Definition of enantiomers- diastereomers- epimers and anomers with suitable examples.

Monosaccharides– configuration – D and L hexoses – aldohexoses and ketohexoses. Glucose- Fructose – Occurrence- preparation- properties-reactions- structural elucidation-uses. Interconversions of sugar series – ascending- descending- aldose to ketose and ketose to aldose.

Disaccharides – sucrose- lactose-maltose - preparation- properties and uses (no structural elucidation).

Polysaccharides – Source- constituents and biological importance of homopolysaccharides- starch and cellulose- heteropolysaccharides – hyaluronic acid- heparin.

UNIT III Tautomerism and Molecular Rearrangement

Tautomerism **–** Definition – Types of tautomerism – Keto-enol- Nitro -acinitro- Lactam - lactim- p-Nitrosophenol- Quinone monoxime and amido-imido tautomerism.

Molecular Rearrangement-Type of rearrangements- Mechanism for Benzidine- Favorskii- Clasien- Hofmann- Curtius- Schmidt and Beckmann- Pinacol-pinacolone rearrangement

UNIT IV Special reagents in organic synthesis

Synthetic reagents-preparation and synthetic applications- diethyl zinc (Frankland reagent)-methyl lithium-diethyl malonate and tetra ethyl lead (TEL).

Organometallic compounds in Organic Synthesis

Preparation and synthetic applications- Grignard Reagents- Organo Lithium Compounds- Ziegler – Natta-Wilkinson catalyst - Nickel tetracarbonyl – Zeise's Salt

UNIT V Green Chemistry

Introduction – need for green chemistry – twelve principles of green chemistry – Green chemistry inday-to-daylife– drycleaning- versatile bleaching agent–atom economy-green solvents – supercritical fluid CO_2- ionic liquids and water. Microwave assisted organic synthesis – introduction – microwave assisted reactions in water– Hofmann elimination

and hydrolysis of benzyl chloride – microwave assisted reactions in organic solvents – esterification and Fries rearrangement – microwave assisted reactions in solid state – deacylation- oxidation of alcohols using clayfen.

Recommended Text

1. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publishing, 4th reprint, 2009.
2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., 3rd edition,2009
3. Arun Bahl and B. S. Bahl, Advanced organic chemistry, New Delhi, S. Chand & Company Pvt. Ltd., Multicolour edition, 2012.
4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 29th edition, 2007.
5. C Bandyopadhya; An Insight into Green Chemistry; Published on 2020

Reference Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, 6th edition, 2012.
2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, 11th edition, 2012.
3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 7th edition,2009.
4. I. L. Finar, Organic Chemistry, Vol. (1 & 2), England, Wesley Longman Ltd, 6th edition, 2006.
5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5th Edition, 2010.

Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	2	2	1	3	3	3	2	3
CO-2	3	3	2	2	1	3	3	2	2	3
CO-3	3	2	2	2	1	3	3	2	2	3
CO-4	3	3	2	2	1	3	3	3	2	3
CO-5	3	3	3	2	1	3	3	2	2	3
Ave.	3	2.8	2	2	1	3	3	2.4	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER VI			
Part III Core IX	**Inorganic Chemistry II**		
Course Code: 23UCHC62	**Hrs./Week: 4**	**Hrs/Sem: 60**	**Credits: 4**

Objectives

This course aims at providing knowledge on

- The formation and bonding in coordination compounds.
- The theories behind the formation of coordination complexes.
- The reaction mechanism in complexes.
- The importance of metals in biological systems and the application of metal chelates in various fields.
- The nature of metal carbonyls and their applications.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	explain ligand, crystal field theory, Substitution reaction in octahedral complexes, Eighteen electron rule and role of metal ion in living systems.	K1
CO-2	discuss co-ordination number, t_2 and e orbitals in tetrahedral complexes, Thermodynamic stability and kinetic stability, classification of carbonyls and metallo proteins.	K2
CO-3	understand oxidation number, Crystal field splitting of complexes, Spiltting of d orbitals in square planar complexes, substitution reactions in square planar complexes, Nature of M-CO bonding in metal carbonyls and metallo enymes.	K3
CO-4	have an idea on isomerism, Crystal field stabilization energy, trans effect, Wade's rules and Na/K pump.	K4
CO-5	explicate stability of complex ions, Jahn- Teller distortion, Electron transfer reactions, Bonding in ferrocene and application of co-ordination compounds.	K5

Unit I Co-ordination Compounds I

Postulates and Limitations of VB theory - Co-ordination compounds –definition –addition (or) molecular compounds double salts-complex salts. Terminology – complex ions (central metal ion) coordination number- ligands - types of ligands (monodentate– bidentate – polydentate - bridging ligands) – Chelating ligands – Oxidation number- co-ordination sphere- effective atomic number (EAN). Nomenclature of coordination compounds – isomerism in co-ordination compound – structural and stereo isomerism. Hydrate isomerism – ligand isomerism – linkage isomerism – geometrical isomerism- coordination isomerism – coordination position isomerism – polymerisation isomerism. Stability of complex ions – Irving William series.

Unit II Co-ordination Compounds II

Crystal field theory –postulates of Crystal field theory- CF splitting in tetrahedral- Relation between Δ_t- Δ_0 and 10 Dq. Distribution of d^x (x=0 to 10) electrons in t_2 and e orbitals in tetrahedral complexes and CF splitting in octahedral complexes - Distribution of d^x (x=0 to 10) electrons in t_{2g} and e_g orbitals in octahedral complexes-. Splitting of d orbitals in square planar complexes – calculating the value of crystal field splitting parameter in square planar complexes - Strong and weak field ligands- High Spin and Low Spin complexes - Spectrochemical series- - Crystal field stabilization energy (CFSE) – factors influencing the magnitude of CF splitting — applications of crystal field theory - magnetic properties- colour of transition metal complexes – Ligand field theory- Jahn Teller theorem- Consequences of Jahn-Teller distortion.

Unit III Reaction Mechanism in Co-ordination Compounds

Thermodynamic Stability - Substitution reaction in octahedral complexes – dissociative (S_N1)- associative (S_N2) mechanism. Thermodynamic stability and kinetic stability- Factors affecting thermodynamic stability and kinetic stability - Substitution reactions in octahedral complexes (acid and base hydrolysis) and substitution reactions in square planar complexes S_N1 and S_N2. Trans effect- pi bonding theory of trans effect – uses of trans effect. Electron transfer reactions – Outer sphere and inner sphere mechanism.

Unit IV Organometallic compounds and Metal clusters

Nomenclature of organometallic compounds- classification of carbonyls- based on the number of metal atoms present in carbonyl- based on the structure of carbonyls - Eighteen electron rule –General methods of preparation- properties of transition metal carbonyls.

Nature of M-CO bonding in metal carbonyls - Structure and bonding in metal carbonyls of mono- bi nuclear and poly nuclear carbonyls of Ni, V, Cr, Fe, Co and Mn. [$(Ni(CO)_4$.) $V(CO)_6$, $Fe(CO)_5$, $Cr(CO)_6$, $Co_2(CO)_8$, $Fe_2(CO)_9$, $Mn_2(CO)_{10}$, and $Fe_3(CO)_{12}$].

Unit V Bio-Inorganic Chemistry

Role of metal ion in living systems (excess and deficiency of trace metals) – metalloproteins- metallo-enzymes –

characteristics of metallo-enzymes – characteristics of metal activated enzymes – functions of metal in enzymes – elementary idea of metallo-porphyrins-Structure and function of haemoglobin- myoglobin and chlorophyll-Function of Na/K pump-Biological functions and toxicity of some elements-Applications of co-ordination compounds in medicine-industry- biological systems and analytical chemistry.

Recommended Texts

1. Puri B.R. Sharma L.R. Kalia. *Principles of Inorganic Chemistry*. Delhi: K.K. Milestone Publishers & Distributors,2019 – 2020.

Reference books

1. Lee J. D. *Concise Inorganic Chemistry*. Blackwell Science Wiley fifth edition, 2008.
2. Gopalan R, Ramalingam V. *Concise co-ordination Chemistry*. Vikas Publishing House Pvt Ltd, 2008.
3. Wahid U Malik, Tuli G.D, Madan R.D. *Selected Topics in Inorganic Chemistry.* S. Chand & Co. Ltd, 2018.
4. Albert Cotton F, Geoffrey Wilkinson, Carlos A. Murillo, Manfred Bochmann. *Advanced Inorganic Chemistry*, John Wiley & Sons. sixth edition 2016.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	2	2	3	3	3	2	3
CO-2	3	3	3	2	2	3	3	3	2	3
CO-3	3	3	3	2	2	3	3	3	2	3
CO-4	3	3	3	2	2	2	2	3	2	3
CO-5	3	3	3	2	2	3	3	3	2	3
Ave.	3	3	3	2	2	3	3	3	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER VI			
Part III Core X	**Physical Chemistry II**		
Code: 23UCHC63	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 4**

Objectives:

The course aims at providing an overall view of the

- Phase diagram of one and two component systems
- Symmetry elements and apply group theory to various molecules
- Basic knowledge about various types of spectra and their applications
- Electrical conductance and transport number.
- Galvanic cells, EMF and significance of electrochemical series.

Course Outcomes

CO. No.	On completion of the course the students should be able to	Cognitive Level
CO-1	construct the phase diagram for one component and two component systems, explain symmetry elements, symmetry operations, electromagnetic spectrum, regions, interaction of radiation with matter, Debye Huckel theory and galvanic cells	K1
CO-2	apply phase rule to freezing mixtures, know group postulates and types of groups, microwave spectroscopy, types of electrodes and applications of EMF measurements	K2
CO-3	explain the properties of component with congruent melting points and solid solutions, Identify point groups, types of electronic transitions , types of cells	K3
CO-4	explain significance of Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance, assignment of point group to water and ammonia, construct electrochemical cell with the help of electrochemical series and calculate cell EMF.	K4
CO-5	demonstrate peritectic change, group multiplication table for C_{2V} factors influencing chemical shift, applications of EMF and significance of conductometric and potentiometric titrations.	K5

UNIT I Phase rule

Definition of terms-derivation of phase rule-application to one component systems – water and sulphur - super cooling- sublimation-two component systems – solid liquid equilibria- simple eutectic (lead - silver and bismuth - cadmium)- freezing mixtures (potassium iodide- water)- compound formation with congruent melting points (magnesium – zinc and ferric chloride – water system)- peritectic change (sodium – potassium)- solid solution (gold-silver)-copper sulphate – water system

UNIT II Group Theory

Symmetry elements and symmetry operations –centre of symmetry –axis of symmetry- plane of symmetry - proper axis of rotation- improper axis of rotation– Inversion and identity operations – symmetry elements in water- ammonia- boron trifluoride- benzene- allene and 1,2-dichloro ethylene-Group postulates and types of groups - abelian and non-abelian groups -order of a group-Point group Assignment of point group to water and ammonia –Rearrangement theorem-Group multiplication table for C_{2V} – molecular point groups

UNIT III Spectroscopy

Electromagnetic Spectrum-Regions- interaction of radiation with matter – Different types of energy levels in molecules – rotation, vibration and electronic levels.

Microwave spectroscopy - Theory -applications in the determination of bond distances in diatomic molecules.

IR Spectroscopy - Vibrational (IR) spectra – theoretical principle – harmonic oscillator and unharmonicity – modes of vibrations – selection rules – Number of fundamental vibrations – Hook's Law -Force constant – Fermi resonance – Overtones- characteristics of IR absorption frequencies – Applications in the determination of bond strength.

UV Spectroscopy-Theory –Verification of Beer Lambert's Law- types of electronic transitions - selection rules – forbidden and Allowed transitions - Chromophore- auxochrome- bathochromic shift- hypsochromic shift hyperchromic and hypochromic effect.

NMR - Introduction – spin moment-theory – number of signals –internal standard (TMS) – chemical shift – factors influencing chemical shift – splitting of the signals- spin-spin coupling- coupling constant-NMR spectrum of ethanol-Magnetic Resonance Imaging

UNIT IV Electrical Conductance and Transference

Debye Huckel theory –Onsager equation (no derivation)- significance of Onsager equation- Debye Falkenhagen effect- Wien effect-Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device)- transport number –determination –Hittorf's method- moving boundary method – factors affecting transport number – determination of ionic mobility-Kohlrausch's law- applications- molar ionic conductance and viscosity (Walden's rule)-applications of conductance measurements – determination of degree of dissociation of weak electrolyte- dissociation constant of weak acid and weak base- ionic product of water- solubility and solubility product of sparingly soluble salts - conductometric titrations – acid base titrations.

UNIT V Galvanic Cells and Applications

Galvanic cell- representation- reversible and irreversible cells- EMF and its measurement – standard cell- relationship between electrical energy and chemical energy- sign of EMF and spontaneity of a reaction- thermodynamics and EMF – calculation of ΔG- ΔH- and ΔS from EMF data- reversible electrodes- electrode potential- standard electrode potential- primary and secondary reference electrodes- Nernst equation for electrode potential and cell EMF-types of electrodes – metal/metal ion- metal amalgam/metal ion- metal- insoluble salt/anion- gas electrode- redox electrode- electrochemical series – applications of electrochemical series.

Applications of EMF measurements - applications of EMF measurements – determination of activity coefficient of electrolytes- transport number- valency of ions- solubility product- ionic product of water and degree of hydrolysis.

Industrial component

Cell- Types-Galvanic cells- lead storage- Ni-Cd, Li and Zn-air- Al-air batteries Fuel cells – H_2-O_2 cell efficiency of fuel cells- corrosion –mechanism- types and methods of prevention.

Recommended Text

1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021.
2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3. Arun Bahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co.
4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
5. J. Rajaram and J. C. Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and CO., 1986.

Reference Books

1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009.
2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985.

3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.

4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001

5. D. N. Bajpai, Advanced Physical Chemistry, S. Chand &Co., 2001

Website and e-learning source

https://nptel.ac.in https://swayam.gov.in

https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPT s/MTS_07_m.pdf

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	1	2	2	1	3	2	3	2	3
CO-2	1	3	2	2	3	2	3	2	2	3
CO-3	3	2	1	2	2	3	2	2	2	3
CO-4	3	3	2	2	2	1	3	3	2	3
CO-5	1	1	3	2	2	3	1	2	2	3
Ave.	2.2	2	2	2.0	2.0	2.4	2.1	2.3	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER VI			
Core Practical V	**Gravimetry and Preparation Inorganic Nanoparticles**		
Code: 23UCHCR7	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 2**

Objective

This course aims at providing knowledge on

- analytical skills and help them to plan and execute experimental projects.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	describe the principles and methodology for the gravimetry.	K1
CO-2	explain the procedure, data and methodology for the gravimetric analysis	K2
CO-3	apply the principles of gravimetry for carrying out the practical work	K3
CO-4	demonstrate laboratory skills for safe handling of the equipment and chemicals	K4
CO-5	explain the preparation of nanoparticles	K5

a) **Gravimetric Analysis**

1. Estimation of Lead as Lead Chromate.
2. Estimation of Barium as Barium Chromate
3. Estimation of Zinc as Zinc Oxinate
4. Estimation of copper as copper (I) thiocyanate
5. Estimation of calcium as calcium oxalate.

b) **Preparation of Inorganic nanoparticles**

1. Preparation by co-precipitation
2. Preparation by sol gel method
3. Preparation by ultrasonication

Course work

1. Estimation of Nickel as Nickel – DMG complex
2. Estimation of Iron/ Nickel by spectrophotometer.
3. Biogenic Synthesis of Silver nanoparticles

Website and e-learning source

https://www.vlab.co.in/broad-area-chemical-sciences

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER VI			
Part III	**Physical Chemistry Practical II**		
Code: 23UCHCR8	**Hrs/Week: 3**	**Hrs/Sem: 45**	**Credits: 2**

Objectives

This course aims at providing

- Basic principles of physical chemistry experiments
- Hands on experience in carrying out the experiments

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	describe the principles and methodology for the practical work.	K1
CO-2	explain the procedure, data and methodology for the practical work	K2
CO-3	apply the principles of phase rule and electrochemistry for carrying out the practical work	K3
CO-4	demonstrate laboratory skills for safe handling of the equipment and chemicals	K4
CO-5	estimate the concentration of unknown by conductometric titration and potentiometric titration	K5

UNIT I Electrochemistry – Conductance measurements

1. Determination of cell constant
2. Determination of molar conductance of strong electrolyte
3. Determination of dissociation constant of acetic acid

Unit II Distribution law

1. Determination of the distribution coefficient of iodine between carbon tetrachloride and water.

UNIT III Electrochemistry

1. Conductometric titration of hydrochloric acid against sodium hydroxide
2. Conductometric titration of Oxalic acid against sodium hydroxide
3. Conductometric titration Precipitation titration
4. Potentiometric titration of ferrous ion against potassium dichromate using calomel electrode.
5. Potentiometric estimation of $KMnO_4$

Reference books

1. Sindhu, P.S. *Practicals in Physical Chemistry*, Macmillan India: New Delhi, 2005.
2. Khosla, B. D. Garg, V. C. Gulati, A. *Senior Practical Physical Chemistry*, R. Chand: New Delhi, 2011.
3. Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New Age International: New Delhi, 2017.

Website and e-learning source

https://www.vlab.co.in/broad-area-chemical-sciences

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER VI			
Discipline Specific Elective	Nanoscience		
Code: 23UCHE61	Hrs./Week: 4	Hrs/Sem: 60	Credits: 3

SEMESTER VI			
Discipline Specific Elective	**Nanoscience**		
Code: 23UCHE61	**Hrs./Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Objectives

This course aims at providing knowledge on

- Introduction to nanoparticles/clusters and nanocomposites
- Properties of nanomaterials
- Characterization of nanomaterials by different methods
- Synthesis of carbon nanotubes, graphene, quantum dots- self- assembled nanomaterials applications of nanomaterials as sensors

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	understand the basic principles of nanoscience, including quantum mechanics, materials science, and the behavior of matter at the nanoscale.	K1
CO-2	learn about the synthesis, properties, and applications of nanomaterials, including nanoparticles, nanocomposites, and nanodevices.	K2
CO-3	gain proficiency in various experimental and analytical techniques used in nanoscience, such as scanning probe microscopy, transmission electron microscopy, and spectroscopy	K3
CO-4	prepare for a career in nanoscience or related fields by gaining an understanding of the current state of research, industry trends, and potential future developments.	K4
CO-5	explore the diverse applications of nanotechnology in different fields, such as medicine, electronics, energy, and materials science.	K5

UNIT I Introduction to nanoscience

Introduction- Characteristics of Nanoscale Materials- Implication for Chemistry- Classification of Nanostructured Materials- Nanoparticles, properties of Nanoparticles- Quantum Dots- Applications in medical Imaging and Diagnostics- Nano wires- Types of Nano wires-applications of Nanowires- Properties and applications of ultrathin films- Multilayered Materials.

Unit II General Methods of Preparation

Synthesis and processing of Nano powders- process for producing ultrafine powders-characteristics of nano particles- Fabrication Methods- Bottom up and Top Down approach- Precipitation- Mechanical milling (Principle, Objective and types) – Physical Vapor Deposition- Evaporation- Sputtering- Types and uses- Bottom up approach- Sol-Gel Method.

UNIT III Nanomaterials

Carbon Fullerenes- Properties- Synthesis and Applications. Graphene- Properties- Carbon Nanotubes- Properties- synthesis (Arc Discharge, Chemical Vapor deposition and Laser Ablation)- Magnesium Oxide Nanoparticle and Manganese Nanoparticle- chemical- physical and Thermal properties- Manufacturing process- Applications- Quantum Dot and Quantum Wire- Carbon Nanotubes as Quantum Wires – applications-electronic devices- sensing using semiconductors nanowires.

UNIT IV Techniques employed for characterization of nanomaterials

Electron Microscopy-types- Principle and procedure- Scanning Electron Microscopy (SEM)-Transmission Electron Microscopy (TEM)– Scanning Tunneling Microscopy (STM)- Atomic Force Microscopy (AFM)- X-Ray diffraction (XRD)-Principles- procedure- types- Wide Angle X-ray Diffraction- Small Angle X-ray Diffraction- Dip Pen Nanolithography (DPN)- Scanning Near Field Optical Microscopy (SNFOM).

UNIT V Application of nanomaterials

Nano Computer- Nano RAM- Characteristics- Super Chip- Electronic nose- Nano Crystal- Synthesis and Application- Nano sensors- Delivery Vehicles- Liposomes- Micelles and Dendrimers- Biodegradable particles- Artificial DNA Nanostructures- applications- Bio Imaging-Nanoparticles for Sun barrier products.

Recommended Text

1. Dr. A. V. Ram Prasad, Dr. S. Venkatanarayanan, Er. B. Gurukarthik Babu, *Fundamentals of Nanoscience,* A. R. Publications, Tamil Nadu, 2017.
2. Sulabha K. Kulkarni, *Nanotechnology: Principles and Practices*, Capital Publishing Co., New Delhi.
3. Pradeep. T, *Nano: The Essentials, Understanding Nanoscience and Nanotechnology*; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007.
4. Shah. M.A.; Tokeer Ahmad, *Principles of Nanoscince and Nanotechnology*; Narosa Publishing House, New Delhi, 2010.

5. Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. JamesMurday, *Textbook of Nanoscience and Nanotechnology*;Universities press, India Ltd ,Hyderabad. 2012.
6. Asim K Das, Mahua Das, *An Introduction to Nanomaterials and NanoScience*, CBS Publishers & Distributors Pvt. Ltd, New Delhi, 2017.

Reference Books

1. Sharma. P.K., *Understanding Nanotechnology*; Vista International Publishing House, Delhi. 2008.
2. Charles P. Poole Jr.; Frank J. Owens. *Introduction to Nanotechnology;* A John Wiley & Sons, INC., Publication, 2003.
3. Viswanathan B., *Nano Materials;* Narosa Publishing House, New Delhi, 2009.
4. Edited by C. N. R. Rao; Muller. A; Cheetham. A. K. *Nanomaterials Chemistry Recent Developments and New Directions*, WILEY-VCH Verlag GMBH & Co.,KGaA, Darmstad.
5. Jing Zhong Zhang, *Optical properties and spectroscopy of Nanomaterials*; World Scientific Publishing Pvt. Ltd., Singapore.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcoms (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	2	3	2	3	2	3
CO-2	3	3	3	3	2	3	2	2	2	23
CO-3	3	3	3	2	2	3	2	3	2	2
CO-4	3	3	3	3	2	3	3	2	2	2
CO-5	3	3	3	3	2	3	3	3	2	3
Ave.	3	3	3	3	2	3	2.5	2.7	2	2.5

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER VI			
Discipline Specific Elective Polymer Chemistry			
Code: 23UCHE62	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Objectives

The course aims at providing an overall view of

- Classification of polymers, preparation of polymers.
- Kinetics of polymerization and characterization of polymers.
- Analytical techniques used to characterize polymers.
- Reactions of polymers.
- Speciality polymers like PVC, PMMA.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	explain classification of polymers, kinetics of condensation and addition polymerisation, molecular weight of polymers reactions of polymers and polyelectrolytes.	K1
CO-2	acquire knowledge on elastomers, polymer processing, determination of molecular weight, functional Groups in the Polymer and types and structure of rubber,	K2
CO-3	understand fibres, characterization of polymers, Molecular weight distribution, polymer technology and vulcanisation of rubber.	K3
CO-4	have an idea about liquid resins, polymer properties, reactivity ratios, thermal properties of polymers, glass transition temperature, processing of polymers, polymer degradation,	K4
CO-5	discuss polymerisation techniques, block and graft copolymers. Crystallinity of polymers, processing of fibres and specialty polymers like PVC, PMMA, rubbers, biodegradable polymers.	K5

UNIT I Introduction

Difference between polymer and macromolecule – classification – synthetic and natural- organic and inorganic- thermoplastic and thermosetting- Plastics- elastomers -fibres and liquid resins.

Techniques of polymerization

Bulk- solution- emulsion and suspension polymerization.

Unit II Kinetics of polymerization

Kinetics of condensation and addition polymerization- ionic- free radical- co-polymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers.

Characterization of polymers

Appearance- feel and hardness- density- effect of heat- solubility- combustion- tensile strength- shear- stress- impact strength- mechanical- thermomechanical and rheological properties of polymers in viscoelastic state.

UNIT III Molecular Weight and Properties of Polymers

Molecular Weight of Polymers- Number Average and Weight Average- Molecular Weight Distribution- Determination of Molecular Weight- polydispersity index – membrane and vapour phase osmometry- light scattering - Zimm plot- ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry – gel permeation chromatography. Thermal properties of polymers – Glass Transition Temperature-State of Aggregation and State of Phase Transitions- Factors Influencing Glass Transition Temperature- Importance of Glass Transition Temperature - Heat Distortion Temperature, TGA / DTA- Crystallinity of Polymers: Crystalline Behaviour- Degree of Crystallinity.

UNIT IV Polymer technology

Reactions of Polymers-Hydrolysis- Acidolysis- Aminolysis- Addition and Substitution Reactions (One Example Each) Cyclisation- Cross-Linking and Reactions of Specific Functional Groups in the Polymer

Processing of polymers – casting- thermoforming- moulding extrusion- compression- blow moulding – foaming- lamination- reinforcing – processing of fibres – melt- wet and dry spinning.

UNIT V Specialty polymers

Polyelectrolytes - conducting polymers - polymeric supports for solid phase synthesis - biomedical polymers - liquid crystalline polymers- electroluminescent polymers.

Polyethylene- PVC- PMMA – polyester- rubber – synthetic and natural- vulcanisation of rubber.

Polymer Degradation

Types of Degradation – Thermal- Mechanical- Ultra Sound- Photoradiation and Chemical Degradation methods.

Rubber-Natural and Synthetic-Structure- Mechanism of Vulcanisation- Biodegradable and Non-Biodegradable Polymers.

Recommended Text

1. Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer Science.
2. New Delhi: New Age International, 2015
3. Misra G.S. Introductory Polymer Chemistry. New Delhi: Wiley Eastern, 2010.
4. Bahadur P and Sastry N V. Principles of Polymer Science. New Delhi: Narosa Publishing House, 2005
5. Ahluwalia, V.K. Anuradha Mishra, *Polymer Science A Text Book,* Ane Books India: New Delhi, 2008.
6. Morrison, R. R.; Boyd, R. N.; Bhattacharjee, S. K. *Organic Chemistry*, 7th ed.; Pearson: New Delhi, 2011.

Reference Books

1. Billmeyer, F.W. Polymer Science. India: Wiley-Interscience, 2007.
2. Seymour, R. B.; CarraherJr. C. E. *Polymer Chemistry: An Introduction,* Marcel Dckker
3. Inc : New York, 1981.
4. Sinha, R. *Outlines of Polymer Technology,* Prentice Hall of India: New Delhi, 2000.
5. Joel R. Fried, *Polymer Science and Technology*, 3rd ed.; Prentice
6. Hall of India: New Delhi, 2014.

Website and e-learning source

1. https://polymerdatabase.com
2. http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1
3. http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.
4. http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weigh ts+of+polymers.pdf

Level of Correlation between PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	2	2	3	3	3	2	3
CO-2	3	3	3	2	2	3	3	3	2	3
CO-3	3	3	3	2	2	3	3	3	2	3
CO-4	3	3	3	2	2	2	2	3	2	3
CO-5	3	3	3	2	2	3	3	3	2	3
Ave.	3	3	3	2	2	3	3	3	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER VI			
Elective	**PHARMACEUTICAL CHEMISTRY**		
Code: 23UCHSE5	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives

The course aims at providing an overall view of

- Drugs design and drug metabolism
- Important indian medicinal plants, common diseases and antibiotics
- Drugs for major diseases like cancer, diabetes and aids
- Analgesics and antipyretic agents
- Significance of clinical tests

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.	K1
CO-2	discuss the development of drugs, structural activity, disease types, and physio-chemical properties of therapeutic agents, significance of medicinal plants, clinical tests and factors for patentability.	K2
CO-3	apply the principles involved in structural activity and drug designing, functions of hematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.	K3
CO-4	explain classification of analgesics and anesthetics, and physiological functions of plasma proteins	K4
CO-5	explain the significance of clinical tests like blood urea, serum proteins and coronary risk index	K5

Unit I Introduction

Important terminologies – drug- pharmacy- pharmacology- pharmacodynamics- pharmacokinetics- pharmacophore- antimetabolites- actinomycetes- bacteria, virus, fungi- mutation, chemotherapy, pharmacopeia- pharmacognosy- toxicology and pharmacotherapeutics.

Classification of drugs – biological Classification –(drugs acting on central nervous system and peripheral nervous system- Chemotherapeutic drugs- pharamcodynamic agent- metabolic diseases and endocrine function) and chemical classification.

Drug receptors and biological responses-Chemistry of drug receptor binding-covalent bond- hydrogen bond- Van der Waals forces.

Unit II Causes of common diseases and their treatment by drugs

Common diseases and their treatment

Insect borne diseases-malaria- filariasis- plague

Air borne diseases-diphtheria- whooping cough- influenza- measles- mumps- common cold- tuberculosis (T.B)

Water borne diseases- cholera- typhoid- dysentery

Disorder of digestive system- Jaundice- respiratory system – Asthma- nervous system- Epilepsy.

Unit III Clinical chemistry cum Hands on Training

Determination of sugar (glucose) in serum- Folin and Wu's method — -determination of serum cholesterol -Sackett' s method for total cholesterol -tests for cholesterol — estimation of glucose in urine -Benedict's test

Important rules of First aid- First aid for cut- abrasions and bruises-bleeding-fractures-fainting composition of first aid box — some common poisons and their antidotes.

Unit IV Blood pressure and cardio vascular drugs

Blood pressure-types and treatment -Hypertension-primary and secondary hyper tension treatment-hypo tension.

Functions and uses of the following drugs

Cardiovascular drugs-antiarrhythmic drugs-quinidine-antihypertensive agents- (hypotensive drugs) — clonidine and reserpine.

Definition for Angiogram and Angioplast.

Unit V Diabetes and hypoglycemic agents

Diabetes types – Diabetes insipidus and diabetes mellitus – control of Diabetes –oral hypoglycemic agents –sulphonyl urease –tolubutamide- chlorpropamide- biguanides- phenformin and metformin.

Recommended Text

1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S.Chand& company, New Delhi.
2. Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultan chand& sons, Delhi.
3. Tripathi K D, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi.
4. Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New age international (P) Limited,Publishers, New Delhi.

Reference Books

1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6th ed ., Himalaya publishing house, Bombay.
2. Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II). Himalaya publishing house, Bombay.
3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi.

Website and e-learning source

1. http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf
2. http://www.indianmedicinalplants.info/
3. https://www.wipo.int/about-ip/en/

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	3	3	3	3	3	3
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CO-4	3	3	3	3	3	3	3	3	3	3
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Mapping	<40%	≥ 40% and < 70%	≥ 70%
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