Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
III	*GEL*	***U24FTA301***	***TAMIL - III***	***60***	***3***	***25***	***75***	***100***

OBJECTIVES:

- தமிழர் வரலாற்றையும், வாழ்வியல் தொன்மையையும் அறிந்து கொள்ளுதல்
- தமிழரின் பண்பாட்டினை அறிந்து கொள்ளுதல் மற்றும் தமிழ்நாட்டிற்கு வந்திணைந்த பிற பண்பாட்டுச் சூழலை உணர்ந்து கொள்ளுதல்.
- மண் சார்ந்த சமூக ஆர்வலர்களையும் ஆளுமைகளையும் அறிதல்.

COURSE OUTCOME(S)

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	தமிழக மற்றும் தமிழர் வரலாற்றை அறிந்து கொள்வர்	**K5**
CO2	தமிழரின் வாழ்வியல் நெறிமுறைகளை உணர்ந்து கொள்வர்	**K3**
CO3	தமிழகத்தின் வெவ்வேறு காலகட்டத்தின் ஆட்சி வரலாற்றை அறிவர்.	**K4**
CO4	தமிழ்ச் சூழலின் இன்றியமையாத காலகட்டங்களை உணர்ந்து கொள்வர்	**K2**
CO5	சமூகத்தின் மேம்பாட்டுக்கு உழைத்திட்ட மறுமலர்ச்சியாளகளைத் தெளிந்து கொள்வவர்.	**K1**

தமிழக வரலாறும் பண்பாடும் - பாடத்திட்டம்

அலகு - 1	**நில வரலாறு** 1. பழங்கால வரலாறு 2. திணை வாழ்வியல் 3. அகழ்வாராய்ச்சியில் தமிழர்	(12 Hours)
அலகு - 2	**சமூக வரலாறு** 1. சங்க கால ஆட்சிமுறை 2. அயல்நாட்டுத் தொடர்புகள் 3. கல்வியும் கலைகளும்	(12 Hours)
அலகு - 3	**ஆட்சியர் வரலாறு** 1. பல்லவர் மற்றும் நாயக்கர் ஆட்சி 2. முகமதியர் மற்றும் மராட்டியர் ஆட்சி 3. போர்த்துகீசியர் மற்றும் ஆங்கிலேயர் ஆட்சி	(12 Hours)
அலகு - 4	**தமிழக விடுதலைப் போராட்டம்** 1. விடுதலைப் போராட்டத்தில் தமிழகம் 2. இந்திய விடுதலையில் தமிழக இசுலாமியர் 3. மொழிப் போராட்டம்	(12 Hours)
அலகு - 5	**சமூக மறுமலர்ச்சியாளர்கள்** 1. நவாப் சி.அப்துல் ஹக்கீம் 2. டாக்டர் ஐடா ஸ்கடர் 3. டாக்டர் மு.வரதராசனார்	(12 Hours)

பார்வை நூல்கள்

1 செய்யுள் திரட்டு - தமிழ்த்துறை, சி.அப்துல் ஹக்கீம் கல்லூரி, 2025 சூன் வெளியீடு

2 தமிழக வரலாறும் தமிழர் பண்பாடும் - டாக்டர் ஆ.இராமகிருட்டினன்
சர்வோதய இலக்கியப் பண்ணை, மதுரை - 01
பத்தாம் பதிப்பு -2012

3 விடுதலைப் போரில் முஸ்லிம்கள் - வி.என்.சாமி
பாவலர் பதிப்பகம், மதுரை - 09
முதல் பதிப்பு -2009

Web Sources

- Tamil Heritage Foundation- www.tamilheritage.org
- Tamil virtual University Library- www.tamilvu.org/ library http://www.virtualvu.org/library
- Project Madurai - www.projectmadurai.org.
- Chennai Library- www.chennailibrary.com .
- Tamil Universal Digital Library- www.ulib.prg .
- Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com

Cos	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	1	3	2	2	-	-	-	-	-	
CO2	1	2	2	3	3	-	-	-	-	-	
CO3	2	2	3	2	3	-	-	-	-	-	
CO4	3	2	2	2	3	-	-	-	-	-	
CO5	3	2	3	2	3	-	-	-	-	-	
Mean Overall Score											

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
IV	*GEL*	***U24FTA401***	***TAMIL - IV***	***60***	***3***	***25***	***75***	***100***

OBJECTIVES

- தமிழ் மொழியின் வழியாக அறிவியல் சிந்தனைகளை வளர்த்தல். தமிழ் இணைய பயன்பாட்டையும், அறிவியல் கலைச்சொல்லாக்கத்தையும் பயிற்றுவித்தல்.
- தமிழ்ச் சூழலில் அதிக பேசுபொருளாக இருக்கின்ற மொழி, பக்தி, நாட்டுநடப்பு மற்றும் நட்புறவு போன்றவற்றை மையப் பொருளாகக் கொண்டுள்ள தற்கால இலக்கியச் செய்திகளை விளங்க வைத்தல்.

COURSE OUTCOME(S)

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	தமிழ்மொழியின் வழியாக அறிவியல் பற்றி சிந்திக்கும் திறன் பெறுவர்.	**K4**
CO2	தமிழிலக்கியப் பரப்பில் நிலம்,கருவி,உயிர் முதலியவை அறிவியலால் நிகழ்ந்த மாற்றங்களை நன்கு உணர்வர்.	**K5**
CO3	இணைய பயன்பாட்டையும், தமிழில் அதன் நிலைப்பாட்டையும், கலைச்சொல்லின் முக்கியத்துவத்தையும் தெரிந்து கொள்வர்.	**K3**
CO4	மொழி, இறையான்மை, நாட்டுநடப்புச் சூழல்களை தற்கால கவிதை வழி உணர்ந்து கொள்வர்	**K2**
CO5	வழிபாடு, நட்புறவு, நாட்டுப்பற்று போன்ற சூழ்நிலைகளைத் தமிழ் உரைநடை இலக்கியங்கள் வழி அறிவர்.	**K2**

தமிழில் அறிவியலும் சூழலியலும் - பாடத்திட்டம்

அலகு - 1	**தமிழரின் அறிவியல் சிந்தனைகள்** 1. ஐந்திணைப் பகுப்பும் சூழலியலும் 2. தொழில்நுட்ப மேலாண்மை 3. நீர் நில மேலாண்மை	(12 Hours)
அலகு - 2	**இலக்கியங்களில் அறிவியல் சிந்தனைகள்** 1. நிலவியல் 2. உலோகவியல் 3. உயிரியல்	(12 Hours)
அலகு - 3	**இணையத் தமிழ்** 1. இணையத் தமிழ் பயன்பாடு –அறிமுகம் 2. இணையத் தமிழ்க் கல்விக் கழகம், இணைய நூலகம் 3. கலைச்சொல்லாக்கம்	(12 Hours)
அலகு - 4	**தமிழ்ச் சூழலியல் (கவிதை)** 1. கவிஞர். முடியரசன் - மொழி உணர்ச்சி 2. கவிக்கோ அப்துல் ரகுமான் - தவறான எண் 3. ஈரோடு தமிழன்பன் - சென்ரியூ கவிதைகள்	(12 Hours)
அலகு - 5	**தமிழர் சூழலியல் (உரைநடை)** 1. தொ.பரமசிவம் - குலதெய்வம் 2. தி.மு.அப்துல் காதர் - முகத்தில் முகம் பார்க்கலாம் 3. வைரமுத்து - தாய்மண்	(12 Hours)

பார்வை நூல்கள்

1 செய்யுள் திரட்டு - தமிழ்த்துறை, சி.அப்துல் ஹக்கீம் கல்லூரி, 2025 சூன் வெளியீடு
2 அறிவியல் தமிழ் - இராதா செல்லப்பன், பாரதிதாசன் பல்கலைக்கழகம், திருச்சி.
3. இணையத்தமிழ் வரலாறு - மு.பொன்ன வைக்கோ பாரதிதாசன் பல்கலைக்கழகம்,திருச்சி.

Web Sources

- Tamil Heritage Foundation- www.tamilheritage.org
- Tamil virtual University Library- www.tamilvu.org/ library http://www.virtualvu.org/library
- Project Madurai - www.projectmadurai.org
- Chennai Library- www.chennailibrary.com
- Tamil Universal Digital Library- www.ulib.prg
- Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com
- Tamil Books on line- books.tamil cube.com

Cos	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	3	2	-	-	-	-	-	
CO2	2	2	3	2	2	-	-	-	-	-	
CO3	2	2	3	2	3	-	-	-	-	-	
CO4	2	2	3	2	3	-	-	-	-	-	
CO5	2	2	2	3	3	-	-	-	-	-	
Mean Overall Score											

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for Second Year UG Courses effective from the year 2025-2026

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
III	*GEL*	***U24FUR301***	***URDU - III***	***60***	***3***	***25***	***75***	***100***

Objectives:

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	**Understand the historical evolution of the Urdu language and different linguistic perspectives.**	**K2**
CO2	**Analyze the prose and poetry contributions of renowned Urdu writers and poets**	**K4**
CO3	**Gain insights into Urdu drama, its structure, significance, and evaluate**	**K5**
CO4	**Develop an appreciation for Rubaiyat by poets**	**K5**
CO5	**Improve formal letter-writing skills for academic, personal, and professional communication.**	**K6**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Syllabus:

UNIT – I - 15 Hours

Tareek-e-Adab-e-Urdu

Urdu Zaban Ki Ibteda-o-Irthiqa

Urdu Ke Muthaluq Mukthalif Nazriyath

UNIT – II - 15 Hours

Urdu Ke Nasar Nigaar aor shoura

Abdul Haleem Sharar

Prem Chand

Faiz Ahmed Faiz

Akbar Alihabadi

UNIT – III - 15 Hours

DRAMA

Darama Ka Tarruf

Kirshan Chender Ka Tarruf

Darwaz-e-Kholdo

UNIT – IV - 15 Hours

RUBAIYAT

Mir Anees ka tarruf

Gulshan Mein Phiroon Ke Sair Sehra

Dehkoon

Akbar Alahbadi ka tarruf

Gaflath Ki Hansi Se aah Bharna Achcha

Amjad Hyderadi ka tarruf

یونٹ -I

- تاریخ ادبِ اردو
- اردو زبان کی ابتداء و ارتقاء
- اردو کے متعلق مختلف نظریات

یونٹ -II

- اردو کے نثر نگار وشعرائ
- عبدالحلیم شرر
- پریم چند
- فیض احمد فیض
- اکبر الہ آبادی

یونٹ-III

- ڈرامہ
- ڈرامہ کا تعارف
- کرشن چندر کا تعارف
- دروازے کھول دو

یونٹ -IV

- رباعیات
- میر انیس کا تعارف
- گلشن میں پھروں کہ سیر صحرا دیکھوں
- اکبر الہ آبادی کا تعارف
- غفلت کی ہنسی سے آہ بھرنا اچھا
- امجد حیدرآبادی کا تعارف
- اس نام کی زندگی پہ کچھ جان تو ہو؟
- اصغر ویلوری کا تعارف
- ڈھونڈا تو کتابوں میں صداقت نہ ملی

یونٹ -V

- خطوط نگاری
- پرنسپل کے نام چھٹی کا خط
- والد/سرپرست کو خط، جس میں کالج کی فیس کی ادائیگی کے لیے رقم مانگی گئی ہو۔

Is Nam Ki Zandagi Pe Kuch Jan Tho Ho **✾✾Asghar Vellori ka tarruf** **Doonda Tho Kithaboon Mein Sadaqth na Mili** **UNIT – V - 15 Hours** **✾✾Khutoot Nigari** **✾✾Letter to the Principal seeking leave** **✾✾Letter to the Father/Guardian asking money for payment of College fees** **✾✾Letter to the Manager of a Firm seeking employment** **✾✾ Letter to a publisher or book seller placing order for books**	❖ ملازمت کی درخواست کرتے ہوئے مینیجر کے نام خط ❖ کتابوں کا آرڈرکرتے ہوئے پبلشر یا کتاب فروش کے نام خط

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self study component in the End Semester Examinations)

Text Books:

NISAB-E-JAMEEL EDITED BY Dr.S.MOHAMED YASSIR & Dr.S.MOHAMED MUDDASSIR

Reference Book:

- Deewan-e-Meer
- Deewan-e-Dard
- Deewan-e-Ghalib
- Kuliyath-e-Momin
- Kuliyath-e-Akbar
- Kuliyath-e- Iqbal
- Kuliyath-e- Jigar
- Kuliyath-e- Saher Ludhyanvi

Web Resources:

1. www.rekhta.org **2.** www.urduchannel.in **3.** www.urducouncil.nic.in

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2							
CO2	2	3	3	2							
CO3	3	2	3	3							
CO4	3	2	2	2							
CO5	3	3	2	3							

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
IV	*GEL*	***U24FUR401***	***URDU - IV***	***90***	***3***	***25***	***75***	***100***

Objectives:

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Understand the fundamentals of Short Story, its definition, and artistic elements.	**K2**
CO2	Analyze and critically appreciate selected works of renowned Urdu fiction	**K4**
CO3	Evaluate the themes, social contexts, and narrative styles of selected Afsanas	**K5**
CO4	Develop critical thinking through Afsanas	**K5**
CO5	Enhance literary expression through general essays and dialogue-writing skills	**K6**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Syllabus:

UNIT – I -- 15 Hours

- **AFSANA**
- Afsane ki Tareef
- Afsane ka fun

UNIT – II -- 15 Hours

- Rajendra Singh Bedi ka tarruf
- Afsana-Bhola
- Prem Chand ka Tarruf
- Afsana- Kafan

UNIT – III -- 15 Hours

- Kirshan Chender ka Tarruf
- Afsana- Jamun Ka Pard
- Ameerunisa ka Tarruf
- Afsana-Dard Ka Ehsaas

UNIT – IV -- 15 Hours

- Ali Akbar Amburi ka Tarruf
- Afsana-KhushNaseeb
- Saadat Hasan Manto ka Tarruf
- Naya Qanoon

UNIT – V -- 15 Hours

- MAZMOON NIGARI
- Mazmoon Nigari Ki Tareef
- Akbaar Bini ke fawaid
- Computer ki Ahmiyath
- Science ke fawaid aur Nuqsanath
- Mukalama Nigari

یونٹ -I

- □ □افسانہ
- □□افسانے کی تعریف
- □□افسانے کا فن

یونٹ - II

- □□راجندر سنگھ بیدی کا تعارف
- □□افسانہ -بھولا
- □□پریم چند کا تعارف
- □افسانہ- کفن

یونٹ -III

- □□کرشن چندر کا تعارف
- □□افسانہ- جامن کا پیڑ
- □□امیرالنساء کا تعارف
- □افسانہ -درد کا احساس

□یونٹ -IV

- □□علی اکبر آمبوری کا تعارف
- □□افسانہ- خوش نصیب
- □□سعادت حسن منٹوکا تعارف
- □افسانہ -نیا قانون

یونٹ -V

- □مضمون نگاری
- مضمون نگاری کی تعریف
- اخبار بینی کے فوائد
- □کمپیوٹر کی اہمیت
- □ سائنس کے فوائد اور نقصانات
- مکالمہ نگاری

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self study component in the End Semester Examinations)

Text Books:

NISAB-E-JAMEEL EDITED BY Dr.S.MOHAMED YASSIR & Dr.S.MOHAMED MUDDASSIR

Reference Book:

- Deewan-e-Meer
- Deewan-e-Dard
- Deewan-e-Ghalib
- Kuliyath-e-Momin
- Kuliyath-e-Akbar
- Kuliyath-e- Iqbal
- Kuliyath-e- Jigar
- Kuliyath-e- Saher Ludhyanvi

Web Resources:

1. www.rekhta.org **2.** www.urduchannel.in **3.** www.urducouncil.nic.in

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2							
CO2	2	3	3	2							
CO3	3	2	3	3							
CO4	3	2	2	2							
CO5	3	3	2	3							

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by

Syllabus for All II Year UG Courses effective from the year 2025-2026

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
III	*GEL*	***U24FEN301***	***English – III***	***60***	***3***	***25***	***75***	***100***

Course Objectives

CO1	To enable learners to acquire self-awareness required in various life situations.
CO2	To enable learners to inculcate positive thinking required in various life situations.
CO3	To help them acquire the attribute of empathy
CO4	To assist them in acquiring creative and critical thinking abilities
CO5	To enable them to learn the basic grammar

Unit I

Prose

1. My Vision for India – Dr. A.P.J. Abdul Kalam
2. On Saying Please – A.G. Gardiner
3. Character is Destiny – Dr. S. Radhakrishnan
4. Time and the Machine – Aldous Huxley

Unit II

Poetry

1. The Daffodils — William Wordsworth
2. Ulysses – Alfred Lord Tennyson
3. The Village School Master—Oliver Goldsmith
4. Telephone Conversation – Wole Soyinka

Unit III

Short Story

1. Three Questions – Leo Tolstoy
2. The Taxi Driver – K.S.Duggal

Unit IV

Readers Theatre

1. The Boy Comes Home – A.A. Milne
2. Love at First Sight – The Tempest – William Shakespeare

Unit V

Lexical Skills

a) Foreign Words and Special Terminology
b) Building Vocabulary
c) Phrasal Verbs
d) Idioms and Phrases

Grammar

a) Adverbs and its kinds
b) Gerund, Participle, Infinitive
c) Tenses – Introduction
d) Present Tense
e) Past Tense
f) Active and Passive Voices
g) Direct and Indirect Speeches

Communication Skills (LSRW)

a) Expressing Sympathy
b) Expressing Gratitude
c) Complaining
d) Apologizing

Composition

a) Public Speaking
b) Seminar
c) Writing a Memorandum
d) Expansion of Proverbs

Prescribed Book: New Vistas in English - III, Board of Editors, Published by Hakeem Publications, Department of English, C. Abdul Hakeem College (Autonomous), Melvisharam-632509. www.cahc.ac.in, Mail: hakeemcollege@edu.in

Web Resources

1.	Telephone Conversation - Wole Soyinka https://www.k-state.edu/english/westmank/spring_00/SOYINKA.html
2.	https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
3.	https://www.litcharts.com/poetry/sarojini-naidu/the-gift-of-india
4.	https://onlinefreenotes.com/on-saying-please/
5.	https://sxlearningenglish.blogspot.com/2021/05/neb-grade-xi-three-questions-leo-tolstoy.html
6.	https://www.xjd.com/t-the-taxi-driver-by-kartar-singh-duggal-summary/?srsltid=AfmBOooteYGglXTMpB5PyBIDdNpxxxRY3ylETvzURDpoKydTS_KZxuaB

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
IV	*GEL*	***U24FEN401***	***English – IV***	***60***	***3***	***25***	***75***	***100***

Course Objectives

CO1	To facilitate self-awareness for handling diverse life situations.
CO2	To cultivate positive thinking skills for various life scenarios.
CO3	To develop empathy as a core attribute.
CO4	To nurture creative and critical thinking abilities.
CO5	To apply acquired grammar knowledge to improve the quality and effectiveness.

Unit I

Prose

1. On Forgetting—Robert Lynd
2. The Face of Judas Iscariot – Bonnie Chamberlin
3. The Eternal Silence of These Infinite Crowds - Nirad C. Chauduri
4. The Gift of Language — J.G.Bruton

Unit II

Poetry

1. Anxiety Monster- Rhona McFerran
2. A River- A.K. Ramanujan
3. La Belle Dame Sans Merci—John Keats
4. I Know Why the Caged Bird Sings – Maya Angelou

Unit III

Short Story

1. Valiant Vicky, The Brave Weaver - Flora Annie Steel
2. A Retrieved Reformation – O Henry

Unit IV

Reader's Theatre & Extract from a play

1. The Quality of Mercy (Trial Scene from the Merchant of Venice)
2. The Giant's Wife a Tall Tale of Ireland – William Carleton

Unit V

Lexical Skills:

a) Common Errors in English
b) Formation of words
c) Spelling and Sound: Introduction to Phonetics
d) Vowels and Consonants

Grammar:

a) Conjunction and its kinds

b) Interjection and its kinds

c) Regular and Irregular Verbs

d) Future Tense

e) Degrees of Comparison

f) Simple, Complex and Compound Sentences

Communication Skills (LSRW):

a) Phoning

b) Offering Help

c) Asking for Information

d) Making an Appointment

Composition:

a) Designing a Resume and Curriculum Vitae

b) Writing covering letter for Resume & CV

c) Preparing Agenda for Meetings

d) Writing Minutes of Meetings

Prescribed Book: New Vistas in English - IV, Board of Editors, Published by Hakeem Publications, Department of English, C. Abdul Hakeem College (Autonomous), Melvisharam-632509. www.cahc.ac.in, Mail: hakeemcollege@edu.in

Web Resources

1	https://www.orwellfoundation.com/the-orwell-foundation/orwell/essays-and-other-works/why-i-write/
2	https://www.litcharts.com/lit/a-retrieved-reformation/summary-and-analysis https://study.com/academy/lesson/a-retrieved-reformation-summary-themes.html
3	https://www.poetrysoup.com/poem/anxiety_monster_1100885
4	https://allpoetry.com/A-River https://writerjyotijha.medium.com/river-a-k-ramanujan-775dcc791a5e
5	https://www.savemyexams.com/igcse/english-literature/edexcel/16/revision-notes/poetry-anthology/part-3-pearson-edexcel-international-gcse-english-anthology/la-belle-dame-sans-merci/
6	https://www.folger.edu/explore/shakespeares-works/the-merchant-of-venice/read/4/1/

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
III	*CC*	***U24MCH301***	***General Chemistry - III***	***75***	***5***	***25***	***75***	***100***

Objectives:

- To study about gases, liquids and types of solids
- To understand the fundamentals of nuclear chemistry and nuclear reactions
- To study the basic chemistry of aliphatic halogen and alkyl halides.
- To recall the preparation and properties of phenols and alcohols.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	**CO Statement** (After completing the course, the students will be able to)	**Cognitive Level**
CO1	Explain the behaviour of gases	**K2**
CO2	Describe the properties of liquid, solids and liquid crystals	**K2**
CO3	Inspect nuclear radiation, radiocarbon dating and nuclear reactions	**K4**
CO4	Apply knowledge to classify and name different aliphatic halogen derivatives, alkyl halides and alcohols	**K3**
CO5	Outline the nomenclature, classification of phenol, aromatic alcohols and thiols	**K2**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

UNIT I - Gaseous state: (15 Hours)

Kinetic theory of Gases: Derivation of kinetic gas equation. Types of Molecular velocities, Maxwell`s distribution of molecular velocities, degrees of freedom of a gaseous molecule, principle of equipartition of energy, collision frequency, collision number and mean free path.

Real Gases: Deviations from ideal behaviour, equations of state for real gases - van der Waal's equation of state, Virial equation of state – critical phenomena, law (principle) of corresponding states.

Unit II - Liquid and Solid State: (15 Hours)

Physical properties of liquids: Vapour pressure, Surface tension and viscosity.

Solid State: Amorphous and crystalline solids, isotropy and anisotropy. Laws of crystallography, Elements of symmetry, unit cell and space lattices, Miller indices, crystal systems, Bravais lattices. X – ray diffraction – Bragg's equation. Simple cubic, body centered cubic, face centered and hexagonal close packing.

Liquid crystals: classification and applications.

UNIT III - Nuclear Chemistry: (15 Hours)

Natural radioactivity - α, β and γ rays; half-life period; Fajan – Soddy group displacement law; Geiger–Nuttall rule; isotopes, isobars, isotones, mirror nuclei, isodiaphers; nuclear isomerism; radioactive decay series, magic numbers, nuclear stability - neutron- proton ratio, binding energy,

packing fraction, mass defect. Simple calculations involving mass defect and B.E., decay constant, half-life period ($t_{1/2}$) - radioactive series.

Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out)

Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.

UNIT IV - Alcohols, Thiols and Phenols: **(15 Hours)**

Alcohols: Classification and Nomenclature. **Monohydric alcohols** – Methods of preparation - Hydrolysis of alkyl halides; Hydration of alkenes, Hydroboration-oxidation of alkenes, Oxymercuration, demercuration of alkenes. Reactions with reference to C-OH Bond Cleavage and O-H Bond Cleavage. Ascent and descent in alcohol series. **Di and Trihydric Alcohols** (Ethylene glycol and Glycerol) – Preparation – Reactions - Oxidative cleavage of C-C bond - Pinacol-Pinacolone rearrangement.

Thios – Nomenclature. Methods of preparation, Properties, reaction with Na, acids & acid halides, aldehydes & ketones, bases and metallic salts – oxidation.

Phenols – Classification and Nomenclature. Preparation from diazonium salts; Cumene hydroperoxide – Dow's process – Raschig process. Properties – Acidic character of phenols and effect of substituents of the acidity. Fries rearrangement - Etherification (Williamson ether synthesis) – Claisen rearrangement – Aromatic Electrophilic substitution reactions – Halogenation; sulphonation; nitration; Friedel-Crafts alkylation and acylation. Reimer-Tiemann reaction – Koble-Schmidt reaction – Nitrosation – Phthalein reaction.

UNIT V - Ethers, Thioethers and Epoxides: **(15 Hours)**

Ethers: Nomenclature and Isomerism – Diethyl ether - Methods of preparation, Reactions – Formation of oxonium salts, Autooxidation, cleavage by acids, reaction with PCl_5 and dilute H_2SO_4; halogenation, structure and uses. Ziesel method for the estimation of alkoxy group.

Thioethers: Nomenclature. Diethyl sulphide - Methods of preparation, Properties – reaction with alkyl halides and halogens - oxidation – hydrolysis. Mustard gas – Structure, preparation and properties.

Epoxides and Crown ethers: Ethylene oxide – structure, preparation, properties and uses. Crown ethers - Structure and Applications as PTC.

 # _____# Self Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

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. 4. 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. 46 46 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.

e-Resources: MOOC components

1. **https://nptel.ac.in/courses/104104101 - Solid state chemistry**
2. **https://nptel.ac.in/courses/103106071 - Nuclear industries and safety**
3. **https://nptel.ac.in/courses/104106119s - Introduction to organic chemistry**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	3	3	3
CO2	3	3	3	-	-	2	3	3	3
CO3	3	3	3	-	-	-	3	3	3
CO4	3	3	3	-	-	-	3	3	3
CO5	3	3	3	-	-	-	3	3	3
Mean	3	3	3	-	-	2	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. K. Abdul Wasi	Dr. S. Zaheer Ahmed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
III	*CC*	***U24MCHP31***	***Practical III - Qualitative Inorganic Analysis***	***45***	***3***	***25***	***75***	***100***

Objectives:

- To understand the concept behind separation and identification of acid/basic radicals in a given salt mixture.
- To understand and enhance the visual observation as an analytical tool for qualitative estimation of cations and anions.
- To develop the skill on systematic analysis of simple inorganic salts and mixture of salts

Course Outcomes (COs) and Cognitive Level Mapping:

COs	**CO Statement** (After completing the course, the students will be able to)	**Cognitive Level**
CO1	Build knowledge on the systematic analysis of mixture of salts.	**K3**
CO2	Analyze the cations and anions in the unknown salt	**K4**
CO3	Identify the cations and anions in the soil and water and to test the quality of water.	**K6**
CO4	Assess the role of common ion effect and solubility product	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Semi - Micro Qualitative Analysis:

1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, iodide, nitrate

2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite. 3. Elimination of interfering acid radicals and Identifying the group of basic radicals

4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium

5. Analysis of a mixture containing two cations and two anions (of which one is interfering type)

Reference Books:

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

2. A. Jeya Rajendran, Microanalytical Techniques in Chemistry: Inorganic Qualitative Analysis, United Global Publishers, 2021.

3. Nagaraj, Kamalesu, Snehal Lokhandwala and Nikhil M Parekh, Textbook of Semimicro Inorganic Qualitative Analysis, 1st Edition, Notion Press, 2023.

4. V. V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rd edition., The National Publishing Company, Chennai, Reprint 2008.

Reference Books:

1. Jeffery G. H., Bassett J., Mendham J., and Denney R. C. Vogel's Textbook of Quantitative chemical analysis, 6th edition, Pearsons Education, 2004.

2. Kolthoff I. M., and Sandell E. B., Text Book of Qualitative Inorganic Analysis, 3rd edition, The Macmillan Company.

e-Resources:

1. https://bit.ly/3tMt2YQ

2.4.1_MIS_and_NJS_Manual_for_Inorganic_semi-micro_qualitative_analysis.pdf (iscnagpur.ac.in)

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

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	3	3	3	3
CO2	3	2	3	2	-	3	3	2	3
CO3	3	3	2	2	-	3	3	3	3
CO4	2	3	2	2	-	3	3	3	3
CO5	3	3	3	3	-	3	3	3	3
Mean	2.8	2.8	2.6	2	-	3	3	2.8	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. A. Ahmed Raza	Dr. S. Zaheer Ahmed

Sem	Category	Course Code	Course Title	Hours	Credits	Int. Marks	Ext. Marks	Max. Marks
III	CC	U24ACH302	Biochemistry - I (Allied)	45	4	25	75	100

Objectives:

- To explain the structure, classification, chemical reactions, derivatives, and biological significance of carbohydrates
- To discuss the structure, classification, properties, synthesis, and biological significance of amino acids, peptides, and proteins
- To study the classification, structure, chemical properties, and biological functions of lipids
- To understand the structure, composition, properties, and functions of nucleic acids
- To recall the functions and deficiency diseases of vitamins and minerals

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Illustrate the classification structure and reactions of carbohydrates, and the biological significance.	K2
CO2	Discuss the classification of amino acids, peptide bond formation and protein architecture.	K3
CO3	Summarize the lipids classification, structure, function and reactions.	K3
CO4	Discuss the composition, functions, and structural aspects of nucleic acids.	K2
CO5	Outline the biochemical functions, of fat-soluble, water-soluble vitamins, and essential minerals.	K3

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit I - Chemistry of Carbohydrates: **(09 Hours)**

Definition, empirical formulae, classification and classification of carbohydrates. Monosaccharides – stereoisomers, enantiomers, epimers, mutarotation. Classification of monosaccharides, chemical reactions of monosaccharides with respect to glucose.

Disaccharides - Occurrence and structure of maltose, lactose, sucrose.

Polysaccharides - Classification based on function (storage and structural), composition (homo and hetero) giving examples. Storage polysaccharides – Starch. Structural polysaccharides – Cellulose.

Unit II - Chemistry of Amino acids Peptides and Proteins: (09 Hours)

Amino acids: Structure, classification of amino acids. Stereochemical aspects of amino acids D-& L- notation. Physical properties: zwitter ions, pI of amino acids, amino acids as ampholytes, melting point, optical rotation, UV absorption and chemical properties of the amino acids due to carboxyl group and amine group.

Peptides: Structure and classification, Ramachandran plot. Solid Phase Peptide synthesis (Merrifield synthesis).

Proteins: Classification of proteins, structural hierarchy of proteins. Primary structure of proteins, methods of determining N- and C- terminal amino acids. Secondary structure–α-helix and beta pleated sheet. Denaturation and renaturation of proteins.

Unit III - Chemistry of Lipids: (09 Hours)

Definition and Bloor's Classification of lipids. Fatty acids and TAG: Saturated fatty acids and unsaturated fatty acids Triacylglycerol - Simple and mixed. Chemical reactions - Saponification, Iodination, Ozonolysis, Auto-oxidation and rancidity of fats.

Definition and significance - Acid Number, Saponification Number, Iodine Number and Reichert-Meissel Number.

Compound lipids – Structure and function of Glycerophospholipids (Cephalin, Lecithin and Phosphatidyl inositol) Phosphosphingolipids (Ceramide, Sphingomyelin), Glycolipids or Cerebrosides (Galacto and Glucocerebrosides). Derived lipids - Steroids - Cholesterol and Lipoproteins.

Unit IV - Chemistry of Nucleic acids: (09 Hours)

Nucleic acids Composition of DNA and RNA. Nucleosides and Nucleotides. Other functions of nucleotides– source of energy, component of coenzymes and secondary messengers. Difference between DNA and RNA.

Chargaff's rule. Watson and Crick model of DNA. Nucleic acid chemistry UV absorption, hypochromic and hyperchromic effects. Effect of alkali and acid on DNA and RNA. Melting of DNA (Tm).

RNA and their types (snRNA, mRNA, tRNA and rRNA), Secondary structure of tRNA – clover leaf model.

UNIT V - Fat Soluble Vitamins: (09 Hours)

Definition, historical background, general characteristics, classification, vitamins, fat soluble vitamins- A, D, E and K.

Water soluble vitamins; Vitamin-C and B-Complex- Thiamine, Riboflavin, Niacin, Pantothenic acid, Pyridoxine, Biotin, Folic acid, Vitamin B12, biochemical functions, recommended dietary allowance, dietary source and deficiency diseases.

Minerals: Sources, physiological importance and diseases due to excess or deficiency of Ca, P, Na, K, Fe, Zn, S, Mg, Se, Cu.

REFERENCES

1. Biochemistry-the chemical reactions of living cells, David E Metzler, 2nd Edition, Elsevier Academic Press,
2. Biochemistry, Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Freeman & co., 7th Edition, 2010.

3. Lehninger AL, Nelson DL and Cox MM, Lehninger principles of biochemistry (7th ed.), New York: W.H. Freeman, 2017.
4. The Vitamins: Fundamental Aspects in Nutrition and Health, F. C. Gerald and J. P. McClung, Elsevier-Academic Press, 5th Edition (2017).
5. Harper's Illustrated Biochemistry, Victor Rodwell et.al., 31st edition, McGrawHill Education Lange ® 2018.
6. Biochemistry,10th edn., Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Gregory J. Gatto, Jr., Mcmillan Education, 2023.

Suggested Books:

1. Fundamentals of Biochemistry, Jain and Jain, S. Chand. 7th edition (2016).
2. Biochemistry, Satyanarayana and Chakrapani, Arunabha Sen Books and Allied (P) Ltd. 5th Edition (2020).
3. Fundamentals of Biochemistry, A Textbook H. P. Gajera, S. V. Patel and B. A. Golakiya International Book Distributing Co, 1st edition (2008).
4. Fundamentals of Biochemistry, A.C. Deb, 9th edition New Central Book Agency (P) Limited, (2014).

e- Resources:

1. https://libguides.richmond.edu/biochem/websites
2. https://biochem.oregonstate.edu/undergraduate/educationalresources?utm_source=chatgpt.com
3. https://www.biochemistry.org/careers-and-education/education/?utm_source=chatgpt.com
4. https://www.jove.com/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	3	3	3
CO2	3	3	3	3	-	-	3	3	3
CO3	3	3	3	3	-	-	3	3	3
CO4	3	3	3	3	-	-	3	3	3
CO5	3	3	3	3	-	-	3	3	3
Mean	3	3	3	3	-	-	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. S. Khaleel Basha	Dr. S. Zaheer Ahmed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
III	*GEL*	***U24SCH301***	***Entrepreneurial Skills in Chemistry (SBS - IV)***	***30***	***2***	***25***	***75***	***100***

Objectives:

The course aims to:

- Develop entrepreneurial skills in students.
- Provide hands-on experience in preparing and developing products.
- Foster start-ups in small-scale industries.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Educate others about adulteration and motivate them to become entrepreneurs	**K3**
CO2	Identify adulterated food items by doing simple chemical tests	**K3**
CO3	Prepare cleaning products and become entrepreneurs essentially translating their scientific expertise into a viable business venture.	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

UNIT I - Entrepreneurship: (10 Hours)

Entrepreneurship: Concept, characteristics and classifications of entrepreneur, Functions of Entrepreneur, Qualities of entrepreneur, Factor Influencing Entrepreneurship, and Role of entrepreneur in the economic development.

Rural Entrepreneur: Concept, steps to Promote Rural Entrepreneurs, Problem of Rural Entrepreneurs, Small Scale Entrepreneurs.

UNIT II - Food Chemistry (10 Hours)

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

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

Dyes

Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing

UNIT III - Hands on Experience (<u>Students can choose any four</u>) (10 Hours)

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

Preparation of Jam, squash and Jelly, Gulkand, cottage cheese.

Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale.

Extraction of oils from spices and flowers.

Testing of water samples using testing kit.

Dyeing – cotton fabrics with natural and synthetic dyes

Printing – tie and dye, batik

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.
3. "Chemistry Entrepreneurship: Turning Ideas into Innovations" – John W. Kozarich
4. "The Lean Startup" – Eric Ries
5. "Innovation and Entrepreneurship" – Peter F. Drucker

Reference Books:

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

2. Chemistry Entrepreneurship, Garcia-Martinez Javier, Wiley-VCH Verlag GmbH, ISBN: 9783527345441.

Website and e-learning sources:

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

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. P. Mohamed Ashfaque	Dr. S. Zaheer Ahmed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
IV	*CC*	***U24MCH401***	***General Chemistry - IV***	***75***	***5***	***25***	***75***	***100***

Objectives:

- To know the thermodynamic concepts of chemical processes.
- To Study the transition elements with reference to periodic properties
- To learn the nomenclature, preparation and properties of ethers, aldehydes, carboxylic acid and ketones

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Explain the terms, processes and various laws of thermodynamics	**K2**
CO2	Outline the second law and third law of thermodynamics	**K2**
CO3	Categorize chemistry of transition elements with respect to various periodic properties and group wise discussions.	**K4**
CO4	List out the chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.	**K4**
CO5	Summarize the chemistry of carboxylic acids, active methylene compounds, halogen substituted acids and hydroxy acids.	**K2**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

UNIT I - Thermodynamics I: (15 Hours)

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 – 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 gases under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv).

Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels. Zeroth law of thermodynamics-Absolute Temperature scale.

Unit II - Thermodynamics II: (15 Hours)

Second Law of thermodynamics: Limitations of first law, Various statements of second law, Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas with changes in temperature, volume and pressure.

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume. criteria for spontaneity; Gibbs-

Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.

Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.

UNIT III - General Characteristics of d-block elements: (15 Hours)

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.

Comparative study of Titanium, Vanadium, Chromium, Manganese and Iron group elements.

UNIT IV - Aldehydes and Ketones: (15 Hours)

Nomenclature of aldehydes and ketones. General preparation – Reduction with acid chloride (Rosenmund reduction); oxo process; Wacker process; oxidation of alkenes (Ozonolysis); oxidation of alcohols; catalytic dehydrogenation of alcohols.

Nucleophilic addition reactions – acid and base catalysed addition reaction; addition of Grignard reagent; HCN; sodium bisulphite and water. condensation reactions – Aldol condensation; Claisen-Schmidt reaction; Claisen reaction; Perkin reaction; Benzoin condensation; Stobbe condensation; Reformatsky reaction; Cannizzaro`s reaction; Mannich reaction and Wittig reaction.

Oxidation, Haloform reaction; Bayer-Villiger oxidation. Reduction – $LiAlH_4$; $NaBH_4$; MPV reduction; Wolff-Kishner reduction and Clemmensen reduction.

UNIT V - Carboxylic Acids and Active Methylene compounds: (15 Hours)

Nomenclature Structure and Classification of carboxylic acids. General methods of preparation, Reactions - Acidity (Effect of Substituents on Acidity) and Salt formation, mechanism of Reduction and substitution in Alkyl or Aryl Group

Preparation and Properties of Unsaturated Carboxylic acids - Acrylic, Crotonic and Cinnamic acids.

Preparation and Properties of Dicarboxylic Acids - Oxalic, Malonic, Succinic, Glutaric, Adipic and Phthalic Acids.

Synthesis involving Active Methylene compounds – Keto-enol tautomerism - Malonic, Acetoacetic and Cyanoacetic Ester: Characteristic reactions of active methylene group and synthetic applications.

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

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.

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.

e-Resources:

MOOC components

1. **https://nptel.ac.in/courses/112102255 - Thermodynamics**
2. **https://nptel.ac.in/courses/104101136 - Advanced transition metal chemistry**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	3	3	3
CO2	3	3	3	-	-	-	3	3	3
CO3	3	3	3	-	-	-	3	3	3
CO4	3	3	3	-	-	-	3	3	3
CO5	3	3	3	-	-	-	3	3	3
Mean	3	3	3	-	-	-	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. K. Abdul Wasi	Dr. S. Zaheer Ahmed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
IV	*CC*	***U24MCHP41***	***Practical IV - Physical Chemistry Practical - I***	***45***	***4***	***25***	***75***	***100***

Objectives:

The course aims at providing an understanding of

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

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (On the successful completion of the course, the students will be able to)	Cognitive Level
CO1	Describe the principles and methodology for the practical work.	K2
CO2	Explain the procedure, data and methodology for the practical work.	K2
CO3	Evaluate various parameters by applying the principles of electrochemistry, thermochemistry, kinetics, colligative properties, and adsorption to experimental systems.	K5
CO4	Demonstrate laboratory skills for safe handling of the equipment and chemicals.	K6

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit–I Chemical kinetics and Thermochemistry (15 Hours)

1. Determination of rate constant of acid catalyzed hydrolysis of an ester (methyl acetate).
2. Determination of order of reaction between iodide and persulphate (initial rate method).
3. Determination of rate constant of acid catalyzed inversion of cane sugar by using Polarimetry.
4. Determination of heat of neutralization of a strong acid by a strong base.
5. Determination of heat of hydration of copper sulphate.

Unit – II Electrochemistry (Conductance measurements) and Colorimetry (15 Hours)

6. Determination of cell constant.
7. Determination of molar conductance of strong electrolyte.
8. Determination of dissociation constant of acetic acid.
9. Determination of concentration of copper sulphate solution by using Colorimetry.

Unit – III Colligative property and Adsorption (15 Hours)

10. (a) Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent. b) Determination of Kf of solvent.
11. Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal.

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self study component in the End Semester Examinations)

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.

e-Resources:

1. **Adsorption - https://www.youtube.com/watch?v=WdQ4Iy27NuM**
2. **Inversion of Cane Sugar - https://www.youtube.com/watch?v=NXV9WILX4ao**
3. **Kinetics - https://www.youtube.com/watch?v=dBbWMTMhgUk**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	2	3	3	3
CO2	3	3	3	-	-	2	3	3	3
CO3	3	3	3	-	-	2	3	3	3
CO4	3	3	3	-	-	2	3	3	3
CO5	3	3	3	-	-	2	3	3	3
Mean	3	3	3	-	-	2	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. M.S.M. Kamil, Dr. S. Mohammed Safiullah,	Dr. S. Zaheer Ahmed

Sem	Category	Course Code	Course Title	Hours	Credits	Int. Marks	Ext. Marks	Max. Marks
IV	CC	U24ACH402	Biochemistry - II (Allied)	45	4	25	75	100

Objectives

- To understand and apply biophysical principles of pH, buffers, diffusion, osmosis, colloidal state, surface tension, and viscosity.
- To study the nature, catalysis, kinetics, and inhibition of enzymes.
- To understand the principles of metabolism, including the pathways of carbohydrates, lipids, amino acids, and nucleic acids, as well as inborn errors of metabolism related to these pathways.
- To understand the generation, damage, and scavenging of free radicals, the role of antioxidants in protection, and the mechanisms of detoxification, including the Cytochrome P450 system.
- To understand and apply biochemical techniques such as centrifugation, spectroscopy, chromatography, electrophoresis, immunotechniques, and the use of clinical analyzers.

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Explain and apply the principles of biophysics in biochemical and physiological contexts.	K3
CO2	Illustrate the nature of enzymes, enzyme catalysis, enzyme kinetics, and inhibition.	K2
CO3	Discuss the metabolic pathways of carbohydrates, lipids, amino acids, and nucleic acids and the clinical significance of inborn errors of metabolism.	K2
CO4	Outline the generation and impact of free radicals and explain the role of antioxidants and detoxification mechanisms	K2
CO5	Apply the principles of biochemical techniques.	K3

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit I - Biophysical principles: (09 Hours)

Definition – Acid and base pH, pOH, buffer, buffering capacity, Ionic product of water, Hendersen Hasselbalch equation, Physiological buffers: Hb - HHb, carbonate bicarbonate, phosphate and protein.

Diffusion & diffusion coefficient and factors affecting diffusion of solute in solution. Osmosis - Vant Hoff's law of osmotic pressure law & mathematical expression (no derivation), mechanism of osmosis, role of osmosis in physiology- Renal dialysis.

Colloidal state in relation to surface forces, surface area, electrical charge, precipitation flocculation. Surface tension and its measurement, factors affecting surface tension Eg. Role of bile in digestion. Viscosity - definition, measurement; Donnan membrane equilibrium.

Unit II - Chemistry of Enzymes: (09 Hours)

Introduction to enzymes: Nature of enzymes, Active site, cofactor and prosthetic group, apoenzyme, holoenzyme, IUB / EC classification of enzymes. Features of enzyme catalysis. Theories of enzyme catalysis - Fischer's lock and key hypothesis, Koshland's induced fit hypothesis. Factors affecting the rate of reactions.

Enzyme kinetics: Enzyme activity - enzyme specificity, Turnover number, specific activity, Katal, IU. Derivation of Michaelis-Menten equation and Lineweaver- Burk plot Significance of Km and Vmax, Kcat and turnover number.

Enzyme inhibition: Reversible inhibition- competitive, uncompetitive, non-competitive with graphical representations using L-B plots, Evaluation of Km and Vmax in the presence of inhibitor. Irreversible inhibition.

Unit III - Metabolism and Inborn error of metabolism: (09 Hours)

Metabolism of Carbohydrates: Reactions and energetics of glycolysis. Fates of pyruvate. Metabolism of Lipids-βoxidation of fatty acids, ATP yield from fatty acid oxidation.

Metabolism of Amino acids General mechanism of amino acid metabolism: Deamination- oxidative and non – oxidative deamination, transamination, decarboxylation. Urea cycle and its significance.

Inborn error of metabolism of carbohydrate metabolism- Von Gierke's Disease (Type I), Protein metabolism - Phenylketonuria, Lipid metabolism – Tay-Sach's Disease and Nucleic acid metabolism- Xanthinuria.

Unit IV - Free Radicals Anti-Oxidants and Detoxification: (09 Hours)

Free radicals, reactive oxygen species, generation, damage, free radical scavenger systems, effect of free radicals on biomembranes.

Antioxidants - antioxidants used *In Vitro*, Naturally occurring antioxidants and their mode of action. Preventive antioxidants and chain breaking antioxidants and clinical significance.

Detoxication- Define, Mechanism of Detoxication- Oxidation, Reduction, Hydrolysis, Conjugation - Types of conjugation reactions and mechanism of detoxication of drugs.

Unit V - Biochemical Techniques: (09 Hours)

Centrifugation; Principles of centrifugation, Differential centrifugation and Density gradient centrifugation. Electrophoresis - General Principle, Factors affecting migration of molecules, Basic principles of SDS-PAGE gel electrophoresis.

Spectroscopy; Lambert's Law, Beer's Law, applications of UV-visible absorption spectrophotometry.

Chromatography; Principle and application of HPLC. Immunotechnique- Principle and applications of Radio-immunoassay (RIA).

REFERENCES:

1. Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay and Nath – Himalaya Publ. House.
2. Physical Biochemistry- Application to Biochemistry and Molecular Biology by David Freifelder. W. H. Freeman & Co. San Fransisco. 2nd Edition
3. Palmer, Understanding enzymes, 4th edition, Prentice Hall/Ellis Horward, Landon 2000.
4. Price, Nicholas C., and Lewis Stevens. Fundamentals of Enzymology. Oxford Science Publications. Second edition. New York, 2010
5. Sembulingam K& Prema Sembulingam, Essentials of medical physiology, 3rd edition, Jaypee Brothers, 2019.
6. Bruce Alberts, Hopkin, Johnson Morgan, Raff, Roberts, and Walter, Essential Cell Biology, 5th edition, W.W. Norton & Company, 2019.
7. Chatterjee, C C, Human physiology, Medical allied Agency. New Delhi 2020.

Suggested Books:

1. Fundamentals of Biochemistry, Jain and Jain, S. Chand. 7th edition (2016).

2. Biochemistry, Satyanarayana and Chakrapani, Arunabha Sen Books and Allied (P) Ltd. 5th Edition (2020).

3. Fundamentals of Biochemistry, A Textbook H. P. Gajera, S. V. Patel and B. A. Golakiya International Book Distributing Co, 1st edition (2008).

4. Fundamentals of Biochemistry, A.C. Deb, 9th edition New Central Book Agency (P) Limited, (2014).

e-Resources:

1. https://libguides.richmond.edu/biochem/websites
2. https://biochem.oregonstate.edu/undergraduate/educational-resources?utm_source=chatgpt.com
3. https://www.biochemistry.org/careers-and-education/education/?utm_source=chatgpt.com
4. https://www.jove.com/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	3	3	3
CO2	3	3	3	3	-	-	3	3	3
CO3	3	3	3	3	-	-	3	3	3
CO4	3	3	3	3	-	-	3	3	3
CO5	3	3	3	3	-	-	3	3	3
Mean	3	3	3	3	-	-	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. S. Khaleel Basha	Dr. S. Zaheer Ahmed

Sem	Category	Course Code	Course Title	Hours	Credits	Int. Marks	Ext. Marks	Max. Marks
III	GEL	U24ACHP42	Allied Practical Biochemistry	45	4	25	75	100

Objectives:

- Estimate biomolecules volumetrically
- Prepare biomolecules from its sources
- Identify biomolecules by qualitative test
- Estimate biomolecules colorimetrically
- Separate biomolecules by chromatography technique

EXPERIMENTS:

I. Volumetric Analysis:

1) Estimation of glycine using formol titration.

2) Estimation of iron.

3) Estimation of ascorbic acid using 2,6-dichlorophenol indophenol.

4) Estimation of soluble calcium in milk using EDTA.

5) Estimation of glucose using Benedict's Quantative reagent.

6) Determination of saponification value of fats.

II. Preparation:

1. Isolation and quantification of starch from potatoes.

2. Isolation and quantification of casein from milk.

III. Identification of biomolecules - Amino acids, proteins, carbohydrates, lipids.

1.Carbohydrates: Molisch Test, Iodine test, Benedict's test, Fehling's test, Osazone test.

2. Amino acids and Proteins:

- Ninhydrin Test, Biuret Test, Precipitation reactions and colour reactions - Xanthoproteic test, Millon's Test, Sakaguchi Test Hopkins- Cole Test, Lead acetate test Sullivan and McCarthy's Test, Isatin Test, Pauly's Diazo Test.

3. Lipids - cholesterol

- Salkowski test
- Lieberman-Burchard test.

4. Nucleic acids:

- Diphenylamine test - DNA
- Orcinol test – RNA

IV. Demonstration Experiment (Not to be asked in the End Semester Examinations)

1. Estimation of proteins using Biuret method.
2. Estimation of Glucose using anthrone method.
3. Separation of sugars and amino acids using paper chromatography.

Reference Books for Practical:

1. An Introduction to Practical Biochemistry – David T Plummer
2. Introductory Practical Biochemistry – Sawhney & Singh
3. Biochemical Methods –S.Sadasivam and A.Manickam
4. Experimental Biochemistry-Rao & Deshpande

REFERENCES

1. Plummer DT, Introduction to practical Biochemistry. Tata McGraw-Hill, New Delhi Education, 2001.
2. Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ.Press.
3. Biochemical Methods, S. Sadasivam, A. Manickam, 3rd Edition, New Age International Pvt Ltd, 2007.
4. Chromatography – G. Abbott.
5. Laboratory Manual in Biochemistry, J. Jayaraman,2011
6. Practical Biochemistry, Geetha Damodaran, Jaypee, 2011
7. An Introduction to Practical Biochemistry, David Plummer, 3rd edition, 2017.

e-Resources:

1. https://prsvkm.kau.in/sites/default/files/documents/prsvkm_laboratory_manual_of_biochemistry.pdf
2. https://jru.edu.in/studentcorner/lab-manual/bpharm/2nd-sem/Lab%20Manual%20-%20Biochemistry.pdf
3. https://ttk.elte.hu/dstore/document/871/book.pdf
4. https://elearning.icar.gov.in/DisplayUG_ECoursesContent.aspx?CourseCode=Hd8PHCE6lLf%2F26S3pYh%214g%3D%3D
5. https://kevingahern.com/biochemistry-resources/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	3	3	3	3
CO2	3	3	3	-	-	3	3	3	3
CO3	3	3	3	-	-	3	3	3	3
CO4	3	3	3	-	-	3	3	3	3
CO5	3	3	3	-	-	3	3	3	3
Mean	3	3	3	-	-	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. S. Khaleel Basha	Dr. S. Zaheer Ahmed

Sem	Category	Course Code	Course Title	Hours	Credits	Int. Marks	Ext. Marks	Max. Marks
IV	GEL	U24SCH401	Forensic Science (SBS - V)	30	2	25	75	100

Objectives:

- To understand the types, detection, and treatment of poisons, including heavy metal contamination and advanced diagnostic methods.
- To explore the causes, detection, and prevention of crimes involving explosives, bullets, and security measures.
- To analyze methods to detect forgery, counterfeit currency, and jewelry authenticity using advanced techniques.
- To study the identification and analysis of tracks, traces, and biological evidence for forensic investigations.
- To examine medical aspects of forensic science, including disease prevention, drug misuse, arson chemistry, and ballistics analysis.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	examine the classification of poisons in the living and the dead organisms.	K2
CO2	get awareness on human bombs, explosives, metal detectors, VVIP security, bullets, and powder burns.	K2
CO3	detect the forgery documents, different types of forged signatures.	K3
CO4	have an idea about tracks, footprints, tool marks, biological analysis, DNA fingerprinting, steroid detection.	K3
CO5	understand medical aspects of AIDS, drug misuse, burn treatment, metabolite analysis, combustion chemistry, and ballistics.	K3

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

UNIT I – Poisons: (06 Hours)

Poisons - types and classification - diagnosis of poisons in the living and the dead -clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.

Unit-II - Crime Detection: (06 Hours)

Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns.

UNIT-III - Forgery and Counterfeiting: (06 Hours)

Documents - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery methods - writing deliberately modified – uses of ultraviolet rays - comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using AAS to detect

counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels - authenticity of diamond.

UNIT-IV - Tracks and Traces: (06 Hours)

Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints -residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and race horses.

UNIT-V - Medical Aspects: (06 Hours)

AIDS - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011.
2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press,Taylor & Francis Group, 2019.
3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basic principles of Forensic chemistry, Humana Press, first edition, 2012.
4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad.
5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.

Reference Books:

1 . Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice Hall, eighth edition,2003
2 . Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014.
3 . Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015.
4 . Max M. Houck & Jay A. Segal, (2006) Fundamentals of ForensicScience, Elsevier Academic press.
5 . Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) HenryLee's Crime Scene Book Elsevier, Academic press.

Website ande-learning source

1. http://www.library.ucsb.edu/ist/03-spring/internet.html
2. http://www.wonder howto.com/topic/forensic-science

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	-	3	3	3	3	3
CO2	3	3	3	-	3	3	3	3	3
CO3	3	3	3	-	3	3	3	3	3
CO4	3	3	3	-	3	3	3	3	3
CO5	3	3	3	-	3	3	3	3	3
Mean	3	3	3	-	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. S. Khaleel Basha	Dr. S. Zaheer Ahmed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
IV	*GEL*	***U24SCH402***	***Instrumental Methods of Chemical Analysis (SBS - VI)***	***30***	***2***	***25***	***75***	***100***

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 thermo/electro analytical techniques
- fundamentals of stoichiometry and the related concentration terms

Course Outcomes (COs) and Cognitive Level Mapping:

COs	**CO Statement** (After completing the course, the students will be able to)	**Cognitive Level**
CO1	Apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry	**K3**
CO2	Explain the importance UV-Visible and Infrared spectroscopy in structural characterization	**K5**
CO3	instrumentation, theory and applications of thermal and electrochemical techniques	**K2**
CO4	Analyze the use of chromatographic techniques in the separation and identification of mixtures	**K4**
CO5	Explain preparation of solutions, stoichiometric calculations	**K2**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

UNIT I - Qualitative and Quantitative Aspects of Analysis: (6 Hours)

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: (6 Hours)

Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

UNIT III - UV-Visible and IR Spectroscopy: (6 Hours)

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.

Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

UNIT IV - Thermal and Electro-analytical Methods of Analysis: (6 Hours)

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. Electroanalytical methods: polarography - principle, instrumentation and applications.

UNIT V - Separation and purification techniques: (6 Hours)

Classification, principle - Solvent Extraction – Chromatography: adsorption, partition & ion exchange. Column, TLC, Paper, Gas, HPLC and Electrophoresis: Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: Development of chromatograms and R_f value.

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

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.

Reference Books:

1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5thedn., 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.htm
4. http://www.britannica.com/EBchecked/topic/108875/separation-and-purification
5. http://www.chemistry.co.nz/stoichiometry.html

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	3	3	3	3
CO2	3	2	3	-	-	3	3	3	3
CO3	2	3	3	-	-	3	3	3	3
CO4	3	3	3	-	-	3	3	3	3
CO5	3	3	3	-	-	3	3	3	3
Mean	2.8	2.8	3	-	-	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. A. Ahmed Raza	Dr. S. Zaheer Ahmed