



Koneru Lakshmaiah Education Foundation
(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

❖ Approved by AICTE ❖ ISO 21001:2018 Certified

Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.
Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

To
The Dean -Academics
K L Deemed to be University
Vaddeswaram

Sub: Minutes of the 10th BOS meeting-Chemistry Department held on 14-05-2025 at F102 from 3:00 PM to 4:00 PM-Virtual Mode Reg.,

Dear Sir,

With respect to the subject to the cited above, planning to conduct the BOS meeting on 14-05-2025 at F102 from 3:00 PM to 4:00 PM -Virtual Mode.

WebEx Link:

<https://kluniversity.webex.com/kluniversity/j.php?MTID=m1b011d13e3522914f565841d0560b81e>

Thanking You,

Yours sincerely

Dr. A. Venkateswara Rao
Chairman BOS – Chemistry

Dr. A. Venkateswara Rao
Head of the Department
Department of Chemistry
Koneru Lakshmaiah Education Foundation
(Deemed to be University)
Green Fields, Vaddeswaram-522 302
Guntur District, Andhra Pradesh



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14-05-2025

DEPARTMENT OF CHEMISTRY MINUTES OF 10th BOARD OF STUDIES MEETING

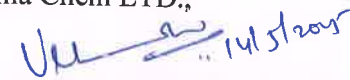
The department of chemistry conducted the 10th BOS meeting on 14-05-2025 in virtual mode (Webex)
Link:

<https://kluniversity.webex.com/kluniversity/j.php?MTID=m1b011d13e3522914f565841d0560b81e>

from 3:00 PM to 4:00 PM.

The following members were present:

1. Dr A Venkateswara Rao, HoD/ Chairperson, KLEF
2. Dr K R S Prasad, Dean-SA & Professor, KLEF
3. Dr J V Shanmukha Kumar, Professor, KLEF
4. Dr. Niranjan Patra, Associate Professor, KLEF
5. Dr. K. Deepti, Dy. HoD, PG Coordinator & Prof. In charge-Academics, KLEF
6. Dr. K. Rambabu, OBE & TLP In charge, KLEF
7. Dr. T. Anusha, Assistant Professor, KLEF
8. Dr. Tinku Baidya, Assistant Professor, KLEF
9. Dr. E. Siva Sankar, RPAC/ Assistant Professor, KLEF
10. Dr. Md. Shahid, Prof. In charge Counselling/ Assistant Professor, KLEF
11. Prof. Suresh Kumar Rayala, Professor, Department of Biotechnology, IIT Madras, Chennai, Tamilnadu.
12. Dr. K. Suresh Babu, Senior Principal Scientist, Department of Natural Products & Medicinal Chemistry, CSIR-IICT Hyderabad.
13. Dr. Moru Satyanarayana, Assoc. Professor, VIT-AP, Amaravathi, AP, India.
13. Dr. V. Sriram, Head of Analytical Development, Bluefish Pharmaceuticals India Pvt Ltd., Bengaluru.
14. Dr. J. Subba Rao, Sr. Group leader, Hetero Research and Foundation, Hyderabad.
15. Dr Addada Ramakrishnam Raju, Senior Research Associative, Vasudha Pharma Chem LTD., Visakhapatnam.


Jr. A. Venkateswara Rao
Head of the Department
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Guntur

16. Dr Srinivas Endoori, Research Associate, Advenchen Laboratories LLC, Moorpark, California, USA
17. Dr. Buchinaidu Nalluri, Director- Life Sciences, KLEF
18. Dr. K. Swapna, HOD- Physics, KLEF
19. Ms. Yasmeen Begum, Student Representative, KLEF
20. Ms. Gousia Shaik, Student Representative, KLEF
21. Mr. Sunkara Vishwanth Chowdary, Student Representative, KLEF
22. Mr. Kuruva Rangamuni, Student Representative, KLEF
23. Ms. Losetty Venkata Naga Triveni, Student Representative, KLEF
24. Ms. Gudimetla Namaswini, Student Representative, KLEF
25. MS. Korukonda Srikala, Student Representative, KLEF
26. Ms. Shaik.Almas Nousheen, Student Representative, KLEF
27. Mr. Katari Anil, Student Representative, KLEF
28. Ms. Golla Teja Vijaya Durga, Student Representative, KLEF

Members Absent:

1. Mr. P. Madan Mohan, Assistant General Manager- IPR, Eisai Pharmaceuticals India Pvt. Ltd., Visakhapatnam.
3. Miss Gayatri Annapareddy, Scientist 2, Eurofins Scientifics, USA


14/5/2015
Dr. A. Venkateswara Rao
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Green Fields, Vaddeswaram-522 302,
Guntur Dist., A.P., India.

Dr. A. Venkateswara Rao, Chairman of BOS opened the meeting by welcoming and introducing the external members to the internal and Special members and thanked them for accepting to become the member of the Board of studies.

After due deliberations, the following resolutions have been adopted.

AGENDA and RESOLUTIONS

AGENDA ITEM 1:

To review and finalize the modified course structure for M. Sc Chemistry 2025 admitted batch	Recommended for approval in academic council
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Dr. A. Venkateswara Rao, HoD, presented the reorganized course structure incorporating revisions in course sequencing to the BOS members. Followed by the presentation, brief discussion was made on the curriculum.

Recommendation: Based on the stakeholder feedback (Prof. Saratchandra Babu, Central Tribal University, Vizianagaram, AP, India., Dr K Deepti, Asst. Professor, KLEF, Guntur, AP, India and Dr. D. Ramachandran, Professor, Acharya Nagarjuna University, Guntur, AP, India.), it is recommended to approve the reorganized course structure incorporating revisions in course sequencing considering the significance of dissertation.

Resolution: The BoS approved the academic structure as proposed. The finalized structure will be incorporated into the academic handbook and recommended for approval in the academic council.

The reorganized program structure for M. Sc Chemistry 2025 admitted batch is shown in **Annexure- I**

AGENDA ITEM-2

To review and approve the syllabus of new course offered to M. Sc Chemistry.	Recommended for approval in academic council
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The syllabus of the newly introduced course *Food Analysis and Quality Assessment* (25CY5222) was presented. The course aims to impart practical analytical skills relevant to food safety and regulatory quality assessment.

Recommendation: Based on the stakeholder feedback (Dr R Suresh Kumar, Professor, IIT- Madras, Chennai, Tamil Nadu, India., Dr A Venkateswara Rao, KLEF, Dr J V Shanmukha Kumar, KLEF, Dr. Rama Krishnam Raju, Vasudha Pharma Chem LTD., Visakhapatnam), emphasizing the growing demand for chemists trained in analytical techniques relevant to food safety, nutrition labelling, and quality control, it is recommended to introduce a new Flexi Core course titled Food Analysis and Quality Assessment into the Y25 curriculum. It supports the department's vision to offer application-oriented learning.


Dr. A. Venkateswara Rao
Head of the Department
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Resolution: The BoS approved the syllabus of Food Analysis and Quality Assessment (25CY5222) and recommended it as a Flexi Core for the Y25 batch and recommended for approval in academic council.

The detailed syllabus of new course for M. Sc Chemistry 2025 admitted batch is shown in **Annexure-II**

AGENDA ITEM – 3

To review and finalize the syllabus revision for M. Sc Chemistry 2025 admitted batch.	Recommended for approval in academic council
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Recommendation: Based on the stakeholder feedback (Dr Moru Satyanarayana, Assoc. Professor, VIT- AP, Amaravathi., Dr A Venkateswara Rao, KLEF, Dr J V Shanmukha Kumar, KLEF, Dr. P. Madan Mohan, Assistant General Manager, Eisai Pharmaceuticals India Pvt Ltd) to promote interdisciplinary learning and broaden academic, employability opportunities for students across departments, it is recommended to include new topics or reconstruct the modules in the existing courses. The Board reviewed course-wise revisions in the syllabus, aligning content with feedback received from stakeholders.

Resolution: It is resolved and approved in the BOS meeting to include new topics or reconstruct the modules in the following existing courses.

25CY5101: Symmetry and Molecular Spectroscopy.

25CY5103: Structural Organic and Stereochemistry.

25CY5207: Biomolecules.

25CY5221: Concepts of Organic Synthesis.

25CY61E3: Advanced Separation and Chromatographic Techniques.

25CY61E5: Nano chemistry.

25CY61E8: Natural Products and Heterocyclic Chemistry.

The revised syllabus for the courses is shown in **Annexure – III.**

AGENDA ITEM 4

To review and finalize the Pre-Ph. D courses offered to Ph. D course work.	Recommended for approval in academic council
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Recommendation: The committee carefully reviewed the structure, syllabus, and relevance of the Pre-Ph.D. courses. The committee recommended the proposed syllabus for research methodology and assignment of new course codes to remain in line with the university's Ph.D. ordinance.

Resolution: It was resolved to approve the following and recommended to present in academic council for approval.

- * Revised syllabus for “25RES101: Research Methodology”
- * Retain the syllabus of other courses offered to Ph. D course work
- * Assignment of Pre-PhD courses with new course codes

The revised syllabus for the courses is shown in **Annexure – IV.**


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AGENDA ITEM 5

To review and finalize the DAC minutes.	Recommended for approval in academic council
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Recommendation: To approve the DAC minutes.

Resolution: It was resolved that the reviewed DAC minutes are approved in BOS and recommended to present in academic council for approval.

AGENDA ITEM 6:

To review and finalize the PDD for Y25 regulation.	Recommended for approval in academic council.
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Recommendation: To approve the PDD of M. Sc Chemistry program for Y25 regulation.

Resolution: It was resolved that the PDD for Y25 regulation is approved in BOS and recommended to present in academic council for approval.

AGENDA ITEM 7:

To review and consider the feedback received from various stakeholders.	Recommended for approval in academic council.
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Recommendation: The feedback collected from various stakeholders (students, academic peers, industry professionals, alumni, parents, and faculty) was reviewed and led to the following resolutions being considered.

Resolution: It is proposed to include 2 industrial visits per year in the curriculum for the Y25 admitted batch students.

AGENDA ITEM 8:

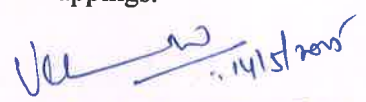
Any other points with the permission of the Chair.	Recommended for approval in academic council.
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Recommendation: The committee reviewed the Course Outcomes (COs) and CO-PO mappings for all existing courses in light of updated POs and PEOs.

The Chair appreciated the efforts of all members and encouraged continuous improvement in the curriculum.

A suggestion was made to explore industry co-taught modules and online certification integration in future curriculum revisions.

Resolution: It is proposed to include 2 industrial visits per year in the curriculum for the Y25 admitted batch students. The committee approved the incorporation of revised COs and CO-PO mappings.


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KLIP Department of Chemistry: 10th BSc meeting 2023/24 100% 1

May 14, 2023 3:42 PM - 4:11 PM

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DEPARTMENT OF CHEMISTRY

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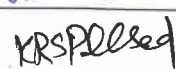
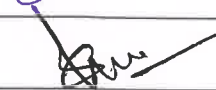
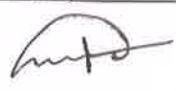
DEPARTMENT OF CHEMISTRY

Type	Sum of CR	No. of Courses	Semester	Sum of CR	Sum of CR
AUC	8	1	1	16	38
OEC	6	3	2	27	26
PEC	23	7	3	24	24
PEC	18	4	3	16	32
PHI	20	3	4	20	22
VAC	0	0			
Grand Total	65	18			

Legend: POC – Professional Core related to Major area, PEC – Professional Elective Courses related to Specialization, PHI – Project, Research or Internship Courses, AUC – Audit Courses, VAC – Value Added Courses, OEC – Open Elective, POC: First core course which leads to specialisation

Graduation requirements: Successful attainment of 80 credits, obtain all PEC credits from courses of specific specialization domain, complete 1 Scopus publication and obtain Satisfactory in all 4 credit courses (AUC, VAC and PHI categories)

Dr. A. Venkateswara Rao
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S. No.	Name	Designation	Position	Signature
1	Dr A Venkateswara Rao	HoD	Chairperson	
2	Dr K R S Prasad	Dean-SA & Professor	Faculty Representative	
3	Dr J V Shanmukha Kumar	Professor	Faculty Representative	
4	Dr. Niranjan Patra	Associate Professor/ Cohort In charge	Faculty Representative	
5	Dr. K. Deepti	Dy. HoD & PG Coordinator	Prof. In charge- Academics/ Cohort In charge	
6	Dr. K. Rambabu	OBE & TLP In charge	Faculty Representative	
7	Dr. T. Anusha	Assistant Professor	Faculty Representative	
8	Dr. Tinku Baidya	Assistant Professor	Faculty Representative	
9	Dr. E. Siva Sankar	RPAC/ Assistant Professor	Faculty Representative	
10	Dr. Md. Shahid	Prof. In charge- Counselling/ Assistant Professor	Faculty Representative	
11	Prof. Suresh Kumar Rayala	Professor, Department of Biotechnology IIT Madras, Chennai, Tamilnadu.	Subject Expert	Attended online
12	Dr. K. Suresh Babu	Senior Principal Scientist, Department of Natural Products & Medicinal Chemistry CSIR-IICT Hyderabad.	Subject Expert	Attended online
13	Dr. Moru Satyanarayana	Assoc. Professor, Dept. of Chemistry, VIT-AP, Amaravathi, Andhra Pradesh, India.	Subject Expert	Attended online
14	Dr. V. Sriram	Head of Analytical Development Bluefish Pharmaceuticals India Pvt Ltd., Bengaluru.	Industry Representative	Attended online
15	Dr. J. Subba Rao	Sr. Group leader Hetero Research and Foundation, Hyderabad.	Industry Representative	Attended online
16	Mr. P. Madan Mohan	Assistant General Manager- IPR, Eisai Pharmaceuticals India Pvt. Ltd., Visakhapatnam.	Industry Representative	
17	Dr Addada Ramakrishnam Raju	SENIOR RESEARCH ASSOCIATIVE,	Alumni Representative	Attended online


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		Vasudha Pharma Chem LTD., Visakhapatnam.		
18	Dr Srinivas Endoori	Research Associate, Advanchem Laboratories LLC, Moorpark, California, USA	Alumni Representative	Attended online
19	Miss Gayatri Annapareddy	Scientist 2 Eurofins Scientifics, USA	Alumni Representative	
20	Dr. Buchinaidu Nalluri	Director- Life Sciences, KLEF	Faculty from other department	Attended online
21	Dr. K. Swapna	Physics-HOD, KLEF	Faculty from other department	Attended online
22	Yasmeen Begum	II M. Sc student, KLEF	Student Representative	Attended online
23	Gousia Shaik	II M. Sc student, KLEF	Student Representative	Attended online
24	Sunkara Vishwanth Chowdary	II M. Sc student, KLEF	Student Representative	Attended online
25	Kuruva Rangamuni	II M. Sc student, KLEF	Student Representative	Attended online
26	Losetty Venkata Naga Triveni	II M. Sc student, KLEF	Student Representative	Attended online
27	Gudimetla Namaswini	I M. Sc student, KLEF	Student Representative	Attended online
28	Korukonda Srikala	I M. Sc student, KLEF	Student Representative	Attended online
29	Shaik. Almas Nousheen	I M. Sc student, KLEF	Student Representative	Attended online
30	Katari Anil	I M. Sc student, KLEF	Student Representative	Attended online
31	Golla Teja Vijaya Durga	I M. Sc student, KLEF	Student Representative	Attended online


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ANNEXURE I: MODIFIED/ REARRANGED ACADEMIC STRUCTURE FOR Y25 REGULATION

It is resolved and approved in the BOS meeting that the modified course structure is approved. The same is permitted by the external, internal, and other stakeholders of BOS for inclusion of modified structure.

S. NO	SEM	Course code	COURSE NAME	Short Name	Mode	Type	L	T	P	S	CR	CH	Prerequi sites
1	1	25UC5201	Professional Communication Skills	PCS	R	AUC	0	0	4	0	0	4	NIL
2	1	25CY5101	Symmetry & Molecular Spectroscopy	SMS	R	PCC	2	1	0	0	3	3	NIL
3	1	25CY5102	Chemical bonding & Coordination Chemistry	CBCC	R	PCC	3	0	4	0	5	7	NIL
4	1	25CY5103	Structural Organic & Stereo Chemistry	SOSC	R	PCC	3	0	4	0	5	7	NIL
5	1	25CY5104	Molecular Thermodynamic s & Chemical Kinetics	MTC K	R	PCC	3	0	4	0	5	7	NIL
6	2	25CY5205	Reaction Mechanism & Organometallic Chemistry	ROM C	R	PCC	3	0	4	0	5	7	CBCC
7	2	25CY5206	Quantum, Surface & Electrochemistr y	QSEC	R	PCC	3	0	4	0	5	7	MTCK
8	2	25CY5207	Biomolecules	BM	R	PCC	3	0	4	0	5	7	SOSC
9	2	25CY5221	Concepts of Organic Synthesis	COS	R	FCC	3	0	0	0	3	3	NIL
10	2	25CY5222	Food Analysis and Quality Assessment	FAQA	R	FCC	3	0	0	0	3	3	NIL
11	3	25CY61E1	Biosensors and Diagnostic Devices	BDD	R	PEC	2	1	0	0	3	3	ST
12	3	25CY61E2	Instrumental Methods of Chemical Analysis	IMCA	R	PEC	3	0	6	0	6	9	NIL
13	3	25CY61E3	Advanced Separation and Chromatographi c Techniques	ASCT	R	PEC	2	1	0	0	3	3	NIL
14	3	25CY61E4	Applied Chemical Analysis	ACA	R	PEC	3	0	6	0	6	9	NIL

14/5/2025

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15	3	25CY61E5	Nano Chemistry	NC	R	PEC	2	1	0	0	3	3	COS
16	3	25CY61E6	Organic Synthesis	OS	R	PEC	3	0	6	0	6	9	NIL
17	3	25CY61E7	Organic Spectroscopy	OSP	R	PEC	2	1	0	0	3	3	NIL
18	3	25CY61E8	Natural Products and Heterocyclic Chemistry	NPHC	R	PEC	3	0	6	0	6	9	NIL
19	2		OPEN ELECTIVE - 1	OE1	M	OEC	3	0	0	0	3	0	NIL
20	3		OPEN ELECTIVE - 2	OE2	M	OEC	3	0	0	0	3	0	NIL
21	2	25IE5201	Essentials of Research Design	ERD	R	PRI	1	1	0	0	2	2	NIL
22	3	25IE6103	Term Paper	TP	R	PRI	0	0	4	0	2	4	NIL
23	4	25IE6205	Dissertation	MAP	R	PRI	0	0	32	0	16	32	NIL
24	2	25CCXXXX	VAC	VAC	R/M	VAC	0	0	0	8	0	0	NIL
			GRAND TOTAL				46	4	76	8	80	120	

Type	Sum of CR	No. of Courses
AUC	0	1
OEC	6	2
PCC	33	7
PEC	18	4
PRI	20	3
FCC	3	1
VAC	0	1
Grand Total	80	19

Semester	Sum of CR	Sum of CH
1	18	28
2	20	26
3	26	34
4	16	32
Grand Total	80	114
Legend: PCC - Professional Core related to Major area, PEC - Professional Elective Courses related to Specialization, PRI - Project, Research or Internship Courses, AUC - Audit Courses, VAC - Value Added Courses, OEC - Open Elective, FCC- Flexi core course which leads to specialization		
Graduation requirements: Successful attainment of 80 credits, obtain all PEC credits from courses of specific specialization domain, complete 1 Scopus publication and obtain Satisfactory in all 0 credit courses (AUC, VAC and PRI categories)		


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ANNEXURE-II

Syllabus Template

FOOD ANALYSIS AND QUALITY ASSESSMENT (FAQA)

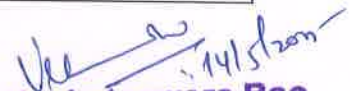
Course Code	25CY5222	Mode	General	LTPS	3-0-0-0	Pre-Requisite	NIL
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Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply knowledge of food regulations, standards, and analytical methods to prepare samples and perform compositional analysis of foods.	3	1, 2, 4
CO2	Use standard analytical techniques to determine the moisture, ash, fat, protein, and vitamin content in food samples.	3	1, 2, 5
CO3	Apply chemical and biochemical methods to analyze food properties such as pH, fat characteristics, protein content, and contaminants.	3	1, 2, 4
CO4	Use physical analysis methods like rheology, thermal analysis, and color measurement to evaluate the physical properties of food materials.	3	1, 2, 5

Syllabus

Module 1	Introduction to Food Analysis, Indian Government Regulations and International Standards Related to Food Analysis, Nutrition Labelling, Evaluation of Analytical Data, Sampling and Sample Preparation.
Module 2	Compositional Analysis of Foods, Moisture and Total Solids Analysis, Ash Analysis, Fat Analysis, Protein Analysis, Vitamin Analysis, Traditional Methods for Mineral Analysis.
Module 3	Chemical Properties and Characteristics of Foods, pH and Titratable Acidity, Fat Characterization, Protein Separation and Characterization Procedures, Application of Enzymes in Food Analysis, Immunoassays, Analysis of Food Contaminants, Residues, and Chemical Constituents of Concern, Analysis for Extraneous Matter, Determination of Oxygen Demand.
Module 4	Physical Properties of Foods, Rheological Principles for Food Analysis, Thermal Analysis, Colour Analysis.


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Reference Books:

S. No	Title	Author(s)	Publisher	Year
1	Food Analysis	Suzanne Nielsen (Ed.)	Springer	2017
2	Food Analysis Theory and Practice	Y. Pomeranz & Clifton E. Meloan	CBS Publishers	2004
3	Principles of Food Chemistry	John M. deMan	Springer	2018
4	Food Chemistry	H.-D. Belitz, W. Grosch, P. Schieberle	Springer	2009
5	Manual of Methods of Analysis of Foods (Food Safety and Standards Authority of India)	FSSAI	Government of India Publications	Latest
6	Introduction to Food Chemistry	Richard Owusu-Apenten	CRC Press	2005
7	Food Proteins and Their Applications	Srinivasan Damodaran, Alain Paraf	CRC Press	1997
8	Food Analysis Laboratory Manual	Suzanne Nielsen	Springer	2010
9	Methods for Food Analysis and Quality Assurance	S. S. Nielsen (Ed.)	Springer	2003
10	Food Analysis and Instrumentation: Theory and Practice	Yeshajahu Pomeranz	Springer	1994


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ANNEXURE III: Program structure (with all Courses) containing following categorization.

Course Name	Course Category	L	T	P	S	CR	Pre-Requisite	New Course/Revised Course/Retained Course	Changes Proposed by	Focused on Employability/Entrepreneurship/Skill Development
Professional Communication Skills	Audit course	0	0	4	0	0	-	Retained	-	Skill Development
Symmetry & Molecular Spectroscopy	Prof. Core	2	1	0	0	3	-	Revised	-	Employability
Chemical bonding & Coordination Chemistry	Prof. Core	3	0	4	0	5	-	Retained	-	Skill Development
Structural Organic & Stereo Chemistry	Prof. Core	3	0	4	0	5	-	Revised	-	Skill Development
Molecular Thermodynamics & Chemical Kinetics	Prof. Core	3	0	4	0	5	-	Retained	-	Skill Development
Reaction Mechanism & Organometallic Chemistry	Prof. Core	3	0	4	0	5	CBC C	Retained	-	Skill Development
Quantum, Surface & Electrochemistry	Prof. Core	3	0	4	0	5	MTC K	Retained	-	Skill Development
Biomolecules	Prof. Core	3	0	4	0	5	SOS C	Revised	-	Skill Development
Concepts of Organic Synthesis	Flexi Core	3	0	0	0	3	-	Revised	-	Employability
Food Analysis and Quality Assessment	Flexi Core	3	0	0	0	3	-	New course	-	Employability
Biosensors and Diagnostic Devices	Prof. Elective	2	1	0	0	3	ST	Retained	-	Employability
Nano chemistry	Prof. Elective	2	1	0	0	3	COS	Revised	-	Employability
Instrumental Methods of Chemical Analysis	Prof. Elective	3	0	6	0	6	-	Retained	-	Skill Development
Advanced Separation and Chromatographic Techniques	Prof. Elective	2	1	0	0	3	-	Replaced	-	Employability
Applied Chemical Analysis	Prof. Elective	3	0	6	0	6	-	Retained	-	Skill Development
Organic Synthesis	Prof. Elective	3	0	6	0	6	-	Retained	-	Skill Development
Organic Spectroscopy	Prof. Elective	2	1	0	0	3	-	Retained	-	Employability
Natural Products and Heterocyclic Chemistry	Prof. Elective	3	0	6	0	6	-	Revised	-	Skill Development
Open Elective - 1	Open Elective	3	0	0	0	3	-	Retained	-	Skill Development
Open Elective - 2	Open Elective	3	0	0	0	3	-	Retained	-	Skill Development
Essentials of Research Design	PRI	1	1	0	0	2	-	Retained	-	Skill Development

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ANNEXURE III

AAA: Percentage Change in syllabus A.Y.: 2025-26

S. No	Course Title	Existing Syllabus	New Syllabus	Topics added/removed/replaced	Changes in Course Outcome(s)	Justification for no change in percentage of change in syllabus	Revision (%)
1	Symmetry & Molecular Spectroscopy	Symmetry and Group theory in Chemistry: Symmetry elements & operations, group, subgroup, Understanding Character Tables of Symmetry Groups, relation between order of a finite group and its subgroup. Point group of symmetry. Schon files symbols, representation of groups by Matrices (representation for C_n, C_{nv}, C_{nh}, D_n etc. groups to be worked out, explicitly). Chirality and molecular vibrations. The great orthogonality theorem (without proof) and its importance. Character tables and their use, Application of group theory in IR and Raman spectroscopy. Spectroscopic methods: Introduction to spectroscopic methods (UV, IR, NMR, MS) - Electromagnetic spectrum, Quantization of Energy in the Hydrogen Atom, Quantization of Energy in poly-electronic atoms, electronic states of diatomic and polyatomic molecules, Classification based on absorption-Emission-Importance- Characterization of electromagnetic radiation -Beer-Lambert's law-deviations from Beers Law, Franck-Condon principle. Dispersive spectrometers, Signal to Noise Ratio, how spectra are obtained. The motion of molecules-Degrees of freedom - Energy associated with the degrees of freedom Type of spectra- Microwave spectroscopy. -	Symmetry and Group Theory in Chemistry: Symmetry and Group theory in Chemistry: Symmetry elements & operations, group, subgroup, Understanding Character Tables of Symmetry Groups, relation between order of a finite group and its subgroup. Point group of symmetry. Schon files symbols, representation of groups by Matrices (representation for C_n, C_{nv}, C_{nh}, D_n etc. groups to be worked out, explicitly). Sub-group, classes and similarity transformation and conjugates. Abelian and non-abelian groups, Representation of groups: Reducible and non-reducible groups, The great orthogonality theorem (without proof) and construction of character table for C_{2v} and C_{3v}. Character tables and their use, Application of group theory in IR and Raman spectroscopy. Spectroscopic methods: Introduction to spectroscopic methods (UV, IR, NMR, MS) - Electromagnetic spectrum, Classification based on absorption-Emission- Importance- Characterization of electromagnetic radiation - Beer-Lambert's law-deviations from Beers Law, Franck-Condon principle. Dispersive spectrometers, Fourier Transform spectrometers, Signal to Noise Ratio, how spectra are obtained. Microwave spectroscopy, Photoelectron Spectroscopy: The motion of	Replaced	CO-1	BOS members	2%

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		Principle-Classification molecules, rigid rotator model, -Microwave spectra of diatomic molecules and polyatomic molecules. Photoelectron Spectroscopy: Basic principles, Koopman's theorem. Photoelectron spectra of simple molecules, Electron spin chemical analysis (ESCA), Auger electron spectroscopy. Electron Spin Resonance (ESR)-Spectroscopy- Theory-ESR lines and intensity-g-values -factors affecting the ESR lines- Zero field splitting and Kramer's degeneracy. Applications of ESR. Raman spectroscopy: Principle-Classical and quantum theories of Anharmonic perturbation, Raman effects, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent anti-stokes Raman Spectroscopy (CARS)-Application. Mossbauer Spectroscopy: Principle- Isomer Shifts - Quadrupole splitting and Magnetic hyperfine splitting - Selection Rules. Applications- X-ray Diffraction-Introduction-principle-Bragg's law-Scherrer Formula-Applications. Laser spectroscopy- General principles of laser spectroscopy, features of lasers and population inversion. Examples of some common lasers - solid state, gas and dye lasers.	molecules-Degrees of freedom -Energy associated with the degrees of freedom Type of spectra- Microwave spectroscopy. - Principle-Classification molecules, rigid rotator model, -Microwave spectra of diatomic molecules and polyatomic molecules. Photoelectron Spectroscopy: Basic principles, Koopman's theorem. Photoelectron spectra of simple molecules, Electron spin chemical analysis (ESCA), Auger electron spectroscopy. Electron Spin Resonance (ESR)-Spectroscopy- Theory-ESR lines and intensity-g-values -factors affecting the ESR lines- Zero field splitting and Kramer's degeneracy. Applications of ESR. Raman spectroscopy: Principle-Classical and quantum theories of Anharmonic perturbation, Raman effects, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent anti-stokes Raman Spectroscopy (CARS)-Application. Mossbauer Spectroscopy: Principle- Isomer Shifts - Quadrupole splitting and Magnetic hyperfine splitting - Selection Rules. Applications- X-ray Diffraction-Introduction-principle-Bragg's law-Scherrer Formula-Applications. Laser spectroscopy- General principles of laser spectroscopy, features of lasers and population inversion. Examples of some common lasers - solid state, gas and dye lasers.				
2	Chemical bonding & Coordination Chemistry	Structure & Bonding: Shapes of molecules (VSEPR Theory, Bent's rule), Valence Bond Theory, Molecular Orbital Theory in explaining the structures of simple molecules [homonuclear diatomic (H_2 , H_2^+ , He_2 , He_2^{2+} , Li_2 , Be_2 , B_2 , C_2 , N_2 , O_2 , F_2), heteronuclear diatomic (HF , CO). Structure and bonding in boron clusters: Preparation, structure and reactions of boranes, carboranes, metallocarbene's, boron-nitrogen ($H_3B_3N_3H_3$), Electron counting in boranes-	Retained	Retained	-	-	-

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		Wades rules (Polyhedral skeletal electron pair theory). Chemistry of transition metal compounds: Limitations of VBT, Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies, Spectrochemical series, Jahn – Teller effect. Electronic spectra of transition metal complexes: Term symbols – Russell – Sander's coupling – derivation of term symbols for various configurations. Spectroscopic ground states. Selection rules, break-down of selection rules. Orgel and Tanabe-Sugano diagrams for d1 – d9 octahedral and tetrahedral transition metal complexes of 3d series – Calculation of DQ, B and β parameters.					
	Structural Organic & Stereo Chemistry	Aromaticity and Aromatic electrophilic substitution: Basic definition of aromaticity, Huckel's rule, intermediates and orientation, electrophiles, reactivity and selectivity, kinetic isotopic effects; Nitration, halogenation, sulfonation, Friedel-Crafts reaction, protonation; Nucleophilic aromatic substitution. Reactive Intermediates: Carbenes, Nitrenes, Radicals, Carbo-cations, ylides, benzyne; Substitution and Elimination reactions; Acid and base concept of organic compounds; Ideal synthesis; fundamentals of retrosynthesis; Functional group transformations, umpolung and protecting groups. Reaction mechanisms: Definition of reaction mechanism, transition state theory, Substituent effects, linear free energy relationships, Hammett equation and related modifications. Basic mechanistic concepts like kinetic vs thermodynamic control, Hammond postulate, Curtin-Hammett principle, isotope	Aromaticity and Aromatic electrophilic substitution: Basic definition of aromaticity, Huckel's rule, intermediates and orientation, electrophiles, reactivity and selectivity, kinetic isotopic effects; Nitration, halogenation, sulfonation, Friedel-Crafts reaction, protonation; Nucleophilic aromatic substitution. Reactive Intermediates: Carbenes, Nitrenes, Radicals, Carbo-cations, ylides, benzyne; Substitution and Elimination reactions; Acid and base concept of organic compounds; Ideal synthesis; fundamentals of retrosynthesis; Functional group transformations, umpolung and protecting groups. Reaction mechanisms: Definition of reaction mechanism, transition state theory, Substituent effects, linear free energy relationships, Hammett equation and related modifications. Basic mechanistic concepts like kinetic vs thermodynamic control, Hammond postulate, Curtin-Hammett principle, isotope	Revised	CO-2, 4	Stakeholder feedback, BOS members	2%
3							

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		effects; Oxidation and Reduction reactions, Chemistry of cyclic and acyclic compounds. Stereochemistry: Introduction, optical isomerism and chirality, resolution, conformational analysis, stereo electronic effect, and stereochemical aspects.	effects; Oxidation and Reduction reactions, Chemistry of cyclic and acyclic compounds. Stereochemistry: Introduction, optical isomerism and chirality, resolution, conformational analysis, stereo electronic effect, and stereochemical aspects. Organic molecules in supramolecular and nano systems.				
	Molecular Thermodynamics & Chemical Kinetics	Thermodynamics: Chemical equilibrium- effect of temperature on equilibrium constant- Van't Hoff equation. Partial molar quantity- different methods of determination of partial molar quantity. Chemical potential- Phase rule and its derivation, Gibbs-Durham equation, Durham- Margules equation, Clausius-Clapeyron equation. Third law of thermodynamics- Determination of the absolute entropy- Apparent exceptions to Third law of thermodynamics. Micelles and Macromolecules: Surface active agents, classification of surface-active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- micro emulsion, reverse micelles. <i>Polymers</i> - Definition, types of polymers, electrical conducting, kinetics of polymerization. Molecular mass- Number and mass average molecular mass, molecular mass determination- Osmometry, viscometry, calculation of average dimensions of various structures. Chemical Kinetics: Theories of reaction rates- Collision theory- Limitations. Transition state theory. Effect of ionic strength-Primary and secondary salt effects. Effect of dielectric constant, effect of substituent, Hammett equation -limitations- Taft equation. Consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation). Specific and	Retained	Retained			

		general acid-base catalysis. Fast reactions-different methods of studying fast reactions-flow methods, relaxation methods-temperature jump and pressure jump methods. Photochemistry: Electronic transitions in molecules, Franck-Condon principle. Electronically, excited molecules- singlet and triplet states, spin-orbit interaction. Quantum yield and its determination. Actinometry. Derivation of fluorescence and phosphorescence quantum yields. Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence- E type and P type. Photochemical reactions-photo types of photochemical reactions-photo dissociation, addition, and isomerization reactions with examples.					
		Modern methods of synthesis: Modern methods of synthesis and reactions of Carbonyl compounds, addition of N, O, and S nucleophiles, Reduction using hydride reagents, chemo and stereoselectivity, formation of enols and enamines, kinetic and thermodynamic enolates. Reagents: lithium and boron enolates in aldol and Michael reactions, stereoselective aldol condensations, alkylation, and acylation of enolates, condensation reactions, Claisen, Dieckman, Knoevenagel, Stobbe and Drazen glycidic ester, acyloin, emphasis on synthetic utility of these reactions, Rearrangements: rearrangement reactions involving electron deficient carbon and the synthetic utility of these rearrangements. Coupling reactions: Heck, Suzuki, Negishi, Stille, Sonogashira coupling Pericyclic reactions: Classification, electrocyclic, sigmatropic, cycloaddition, cheletropic and ene reactions, Woodward-Hoffmann rules, frontier orbital and orbital symmetry correlation approaches, examples highlighting	Modern methods of synthesis: Modern methods of synthesis and reactions of Carbonyl compounds, addition of N, O, and S nucleophiles, Reduction using hydride reagents, chemo and stereoselectivity, formation of enols and enamines, kinetic and thermodynamic enolates. Emerging Trends and Green Chemistry in Organic Synthesis (Green chemistry principles, Organo catalysis and phase-transfer catalysis, Designing environmentally benign synthesis routes for pharmaceuticals and fine chemicals). Reagents: lithium and boron enolates in aldol and Michael reactions, stereoselective aldol condensations, alkylation, and acylation of enolates, condensation reactions, Claisen, Dieckman, Knoevenagel, Stobbe and Darzen glycidic ester, acyloin, emphasis on synthetic utility of these reactions. Protecting groups in synthesis: alcohol, carbonyl, and amine protection. Rearrangements: Rearrangement reactions involving electron deficient carbon, nitrogen, oxygen centres and the synthetic	Revised	CO-1,2,3,4	Stakeholder feedback	5%
5	Concepts of Organic Synthesis						

		pericyclic reactions in organic synthesis, stereochemical aspects.	utility of these rearrangements. Coupling reactions: Heck, Suzuki, Negishi, Stille, Sonogashira coupling and their applications. Introduction to C-H activation and functionalization. Pericyclic reactions: Classification, electrocyclic, sigmatropic, cycloaddition, cheletropic and ene reactions, Woodward-Hoffmann rules, frontier orbital and orbital symmetry correlation approaches, examples highlighting pericyclic reactions in organic synthesis, stereochemical aspects. Introduction to photochemical reactions in organic synthesis.			
6	Food Analysis and Quality Assessment	NEW	Introduction to Food Analysis, Indian Government Regulations and International Standards Related to Food Analysis, Nutrition Labelling, Evaluation of Analytical Data, Sampling and Sample Preparation. Compositional Analysis of Foods, Moisture and Total Solids Analysis, Ash Analysis, Fat Analysis, Protein Analysis, Vitamin Analysis, Traditional Methods for Mineral Analysis. Chemical Properties and Characteristics of Foods, pH and Titratable Acidity, Fat Characterization, Protein Separation and Characterization Procedures, Application of Enzymes in Food Analysis, Immunoassays, Analysis of Food Contaminants, Residues, and Chemical Constituents of Concern, Analysis for Extrinsic Matter, Determination of Oxygen Demand. Physical Properties of Foods, Rheological Principles for Food Analysis, Thermal Analysis, Color Analysis.	Added	CO-1,2,3,4	Stakeholder feedback, BOS members, Academic Peers 100%


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7	Essentials of Research Design	INTRODUCTION TO METHODOLOGY: Format of thesis and dissertation, Research article, Reviews, Monographs, Bibliography, Literature search, Significance of research, Research methods versus methodology, Research and Scientific methods, Defining the research Problem and Research design. Quantitative Methods for Problem Solving: Introduction to Statistical Modeling and Analysis, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis. Physical Statistical Methods: Definition and Scope; Types of data; Collection and presentation of Data (Tables, Graphs, Diagrams); Measure of Central Tendency; Dispersion; Goodness of fit (X² Test). Sampling Fundamentals: Census and sample Survey, Steps in sample design, Different types of sample design, Selection of a random sample, Estimation, Estimating the population mean and population proportion. Interpretation and Report Writing: Meaning of interpretation; Techniques of interpretation; Precautions in Interpretation; Significance of Report writing; Different steps in Report writing; Layout of Research Project; Types of Reports; Patent writing and filing and Oral presentation.	Retained	Retained	Retained	Retained	Retained
8	Reaction Mechanism & Organometallic Chemistry	Reactivity of coordination complexes – inert and labile complexes –ligand substitution reactions in octahedral and square planar complexes –Trans effect– electron transfer reactions – inner and outer sphere electron transfer mechanisms. Thermodynamics of complex formation in aqueous medium – stepwise and overall formation constants – factors affecting formation constant –	Retained	Retained	Retained	Retained	Retained

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		determination of formation constant-HSAB principle to explain the stability of coordination compounds. Organometallic complexes of d-block element – 16 and 18 electron rules – Synthesis, structure and spectral properties of metal carbonyl and metal nitrosyl complexes-Fischer and Schrock carbene complexes. Metal clusters – metal-metal bonds – carbonyl and non-carbonyl clusters – isolable analogy and application of Wade's rule – Zintl ions – Chevrel phases. Catalysis: Homogeneous (Hydrogenation, hydroformylation, acetic acid synthesis, metathesis and olefin oxidation) and heterogeneous (Fischer-Tropsch reaction, Ziegler Natta Polymerization, Haber process).				
9	Quantum, Surface & Electrochemistry	Quantum Mechanics: Introduction to quantum mechanics. Schrödinger wave equation. Time-independent and time dependent Schrödinger wave equations and the relation between their solutions. Eigenfunctions and Eigenvalues. Physical Interpretation of wave function. Concepts of Operators: Laplacian, Hamiltonian, Linear and Hermitian operators. Angular Momentum operators and their properties. Commutation of operators. Normalization, orthogonality and orthonormality of wave functions. Average (expectation) values. Postulates of quantum mechanics. Solutions of Schrödinger wave equation for a free particle, particle in a ring, particle in a three-dimensional box. Quantum mechanical degeneracy, tunneling (no derivation). Application of Schrödinger equation to harmonic oscillator, rigid rotator. Surface phenomena: Types of adsorption isotherms, Effect of temperature on adsorption, Mechanical adsorption, Estimation of surface area using BET equation, Gibbs adsorption isotherm and its significance, Surface tension and surface energy, Pressure	Retained	Retained	-	-


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		difference across curved surface (Laplace equation), Vapor pressure of droplets (Kelvin equation), Surface film on liquids (electrokinetic phenomena), Electrochemistry: Activity coefficients and ion-ion interactions. Physical significance of activity coefficients, mean activity coefficient of an electrolyte and its determination. Derivation of the Debye-Hückel theory of activity coefficients the electrode-electrolyte interface. The electrical double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model. Electrodes: Charge transfer reactions at the electrode-electrolyte interface. Derivation of Butler-Volmer equation. Tafel equation, Low field equilibrium, Nernst equation. Statistical Thermodynamics: Fundamentals: Idea of microstates and macro states. Concept of distributions- Binomial & multi-nominal distributions for non-degenerate and degenerate systems, Thermodynamic probability, and most probable distribution. Canonical and other ensembles. Statistical mechanics for systems of independent particles and its importance in chemistry. Types of statistics: Boltzmann, Bose-Einstein, and Fermi-Dirac statistics. Thermodynamic probability (W) for the three types of statistics. Derivation of distribution laws (most probable distribution) for the three types of statistics. Lagrange's undetermined multipliers.					
10	Biomolecules	Carbohydrates: Classification, Physicochemical properties- stereochemistry- Chemistry, Structure and functions of monosaccharides, disaccharides, polysaccharides- Mucopolysaccharides- Deoxy sugars, amino sugars, reactions of carbohydrates- Proteoglycans, Glycoproteins	Carbohydrates: Classification, Physicochemical properties- stereochemistry- Chemistry, Structure and functions of monosaccharides, disaccharides, polysaccharides- Mucopolysaccharides- Deoxy sugars, amino sugars, reactions of carbohydrates- Proteoglycans, Glycoproteins	Revised	CO-1,2,4	Stakeholder feedback	5%

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	and Glycolipids- separation of carbohydrates. Amino acids & Proteins: α- Amino acids: Classification, Structure Physicochemical properties, and biological significance- synthesis and reactivity; Peptides: bond, Peptides of biological importance; Chemical synthesis of peptides – Solid phase peptide synthesis; Proteins – Classification, Isolation, Purification and Characterization of proteins, structure, functions, properties, and significance; Enzymes- Characteristics and functionality. Inhibition, and drug design principles. Protein misfolding diseases: Alzheimer's, prion diseases, Nucleic Acids: Basic Structure, Biological significance, Reactions of Nucleic acid bases, Physicochemical properties of Nucleic Acids, DNA- structure, denaturation, RNA, Functions of Nucleotides, Structure, and properties of nucleotides, nucleosides, purine (Adenine, Guanine) and pyrimidine (Cytosine, Thiamine, Uracil) bases. Structural features of nucleic acids (DNA & RNA) and their biological functions. Lipids: Classification, role of lipids, fatty acids and glycerol derived from oils and fats; Physical properties - polymorphism, reactions of fats, rancidity, saponification, addition, hydrogenation, phospholipids, lipid metabolism; intermediary metabolism of fatty acids, synthesis of fatty acids.	and Glycolipids- separation of carbohydrates. Industrial and biomedical applications, Amino acids & Proteins: α- Amino acids: Classification, Structure Physicochemical properties, and biological significance- synthesis and reactivity; Peptides: bond, Peptides of biological importance; Chemical synthesis of peptides – Solid phase peptide synthesis; Proteins – Classification, Isolation, Purification and Characterization of proteins, structure, functions, properties, and significance; Enzymes- Characteristics and functionality. Inhibition, and drug design principles. Protein misfolding diseases: Alzheimer's, prion diseases, Nucleic Acids: Basic Structure, Biological significance, Reactions of Nucleic acid bases, Physicochemical properties of Nucleic Acids, DNA- structure, denaturation, RNA, Functions of Nucleotides, Structure, and properties of nucleotides, nucleosides, purine (Adenine, Guanine) and pyrimidine (Cytosine, Thiamine, Uracil) bases. Structural features of nucleic acids (DNA & RNA) and their biological functions. Lipids: Classification, role of lipids, fatty acids and glycerol derived from oils and fats; Physical properties - polymorphism, reactions of fats, rancidity, saponification, addition, hydrogenation, phospholipids, lipid metabolism; intermediary metabolism of fatty acids, synthesis of fatty acids. Lipids in nanomedicine: Lipid nanoparticles for drug delivery. Lipid profiling by TLC.			
11	Biosensors and Diagnostic Devices Introduction to Biosensors: Definition and historical perspective, Various components of biosensors, working mechanism, Probes: antibodies, nucleic acids, enzymes, receptors etc. Methods for probe attachment to surfaces Adsorption; chemisorption, physisorption, polymer trapping, covalent attachment, film	Retained	Retained	-	-

		deposition techniques; molecularly imprinted polymers and biomimicry. Biosensor construction and modification, Electrodes: carbon (graphene, carbon nanotubes, fullerene, corannulene) metal nanoparticles, polymer, nanocomposites, Thin-Film Electrodes and Screen-Printed electrodes etc. based electrodes. Sensor characteristics: calibration, dynamic range, signal-to-noise ratio, sensitivity, selectivity, interference etc. Surface characterization and Transducers: Techniques used to characterize biosensors (UV-Vis, FT-IR, SEM, AFM, XPS, XRD etc.), Various types of transducers and detection methods; principles of Calorimetric, Optical, Electrochemical, Impedimetric, and Chemiluminescence-based Biosensors. Design and Applications of Biosensors: Fabrication and applications of colorimetric, fluorescence, voltammetric, amperometric, and optical biosensors. Working principles of some commercialized biosensors- Glucose biosensor, Urea/Uric Acid biosensor, Pregnancy test biosensor etc. Immunosensors and clinical applications, Biosensors for drug resistance and environmental pollution. Diagnostic Devices: Point of care device, necessity and applications, Lab-on-Chip platform, Microfluidic device, Introduction-antigen-antibody binding and assays; Immunoassays -types (RIA, ELISA, Chemiluminescent IA, FIA), working mechanism of few commercial point of care devices.					
12	Nano chemistry	Introduction: Scope and importance of nano chemistry. Types of nanostructures, Properties of nanomaterials: Chemical, and Physical. Role of particle size, Concept of confinement, strong and weak confinement with suitable examples, Size and shape dependent optical, electronic, photonic, magnetic, properties.	Introduction: Scope and importance of nano chemistry. Types of nanostructures, Properties of nanomaterials: Chemical, and Physical. Role of particle size, Concept of confinement, strong and weak confinement with suitable examples, Size and shape dependent optical, electronic, photonic, magnetic, properties.	Revised	CO-1,3,4	Stakeholder feedback	5%

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	Synthesis: Bottom-up synthesis of nanomaterials; Chemical precipitation; Sol-gel synthesis; Microemulsions or reverse micelles; Hydrothermal routes, Microwave heating synthesis; Top-down synthesis of nanomaterials: ball milling, photolithography, laser ablation, CVD. Green pathways to synthesize nanomaterials. Characterization methods: X-ray absorption spectroscopy, BET method for surface area analysis. Dynamic light scattering for particle size determination. Metal nanoparticles in catalysis: Catalysis by nanoparticles in Gas-Phase Reactions: CO Oxidation, Propylene Epoxidation, Catalysis by nanoparticles in Liquid-Phase Reactions: Hydrogenations, Coupling Reactions (Sonogashira, Hiyama-Denmark, Heck-Mizoroki, Suzuki-Miyaura Cross-Coupling), Oxidation of Alcohols (Alcohols to Aldehydes, Aldehydes to Carboxylic Acids, Esterification of Alcohols and Aldehydes). Electrochemical catalysis using nanomaterials, Nanozymes and biomimetic catalysis. Applications of nano chemistry in energy, environment, and health. Hydrogen energy and development. Hydrogen storage. Carbon capture, Transformation of CO ₂ to fine chemicals. Environmental remediation by chemical degradation/removal of contaminants. Nanomaterials as sorbents.	Bio-nano chemistry: Nano in biological systems and nanotoxicity. Nanoparticles synthesis: Bottom-up synthesis of nanomaterials: Chemical precipitation; Sol-gel synthesis; Microemulsions or reverse micelles; Hydrothermal routes, Microwave heating synthesis; Top-down synthesis of nanomaterials: ball milling, photolithography, laser ablation, CVD. Green pathways to synthesize nanomaterials. Characterization methods: X-ray absorption spectroscopy, BET method for surface area analysis. Dynamic light scattering for particle size determination. Metal nanoparticles in catalysis: Catalysis by nanoparticles in Gas-Phase Reactions: CO Oxidation, Propylene Epoxidation, Catalysis by nanoparticles in Liquid-Phase Reactions: Hydrogenations, Coupling Reactions (Sonogashira, Hiyama-Denmark, Heck-Mizoroki, Suzuki-Miyaura Cross-Coupling), Oxidation of Alcohols (Alcohols to Aldehydes, Aldehydes to Carboxylic Acids, Esterification of Alcohols and Aldehydes).			
	Basic Grammar - Countable and uncountable nouns, present simple and continuous, past simple and continuous – classroom practice – Understand and interpret Texts and	Retained	Retained		

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					workplace situations B) Structural Pattern - Present continuous for future arrangements State verbs, Regular and irregular verbs, Voice, Modal verbs - Reporting on going tasks in the corporate world. C) Descriptive and Qualitative Patterns: Adjectives and Adverbs classroom practice) Time Expressions, Comparatives and superlatives, Pronouns, Conditionals, Phrases and clauses (Including Relative). COMPETENCY: 2: a) Formal contexts: Being a PA, describing changes in a company Taking orders over the phone. b) Listening & Speaking: Participate in conversation with proper contextual language markers, turn taking. Classroom practice- Presenting context, reason, problem - Case analysis (short). Body Language: Dos and Don'ts of one-to-one interaction, Telephone interaction Video/web conferencing. Culture specific practices. Work Etiquette- situation, ambience, team skills, time management and leadership ability. COMPETENCY: 3: Understand and assimilate main ideas and specific details. (250-300 words text of moderate difficulty). A) Read for general understanding, interpreting, factual or specific information, for grammatical accuracy and information transfer. B) Understand the general meaning of corporate context and office correspondence. d) Understand short reports of predictable nature. COMPETENCY: 4: a) Internal Correspondence. Making notes on routine matters, such as, taking/ placing orders. B) Emails: Types of emails, salutations, vocabulary used in formal and informal
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		(Including beginnings and endings). C) Writing straight-forward, routine letters of factual nature.					
14	Term Paper	RETAINED	Retained	Retained	Retained	Retained	Retained
15	Instrumental Methods of Chemical Analysis	Electro analytical Methods of Analysis: Polarographic principles, polarogram and polarographic currents, charging or capacitive current, role of supporting electrolyte, factors affecting polarographic wave, Ikavic Equation, advantages and disadvantages of DME, polarographic maxima and maxima suppressors, interference due to dissolved oxygen, Applications, numerical problems. Differential pulse polarography, square wave polarography, Anode stripping voltammetry: principle, instrumentation, hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltammetry. Principle of cyclic Voltammetry, cyclic voltammogram of K ₃ [Fe (CN) ₆], and parathion, criteria of reversibility of electrochemical reactions, Quasi reversible and irreversible processes. Coulometric analysis: principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations-As (III), Fe (II) and I- and S ₂ - by using I ₂ liberations and Ce ⁴⁺ liberation in solutions. UV-Visible Spectroscopy: Single and double beam spectrophotometers-instrumentation, sources of radiation, detectors, determination of certain metal ions by using ligands, simultaneous determinations of dichromate and permanganate in a mixture, spectrophotometric titrations.	Retained	Retained	Retained	Retained	Retained

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Techniques	Fractional distillation, Molecular distillation), Problems with the LLE Process. Chromatography theory and principle: Classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis. Principles of chromatography, different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm. Dynamics of chromatography-efficiency of chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Deemter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis. Planar and Column Chromatography: Thin layer Chromatography: principle, chromatographic media-coating materials, applications, activation of adsorbent, sample development, solvent systems, development of chromat plate, types of development, visualization methods, documentation, applications in separation, HPTLC-principle, technique, applications. Paper Chromatography: - Principle, papers as a chromatographic medium, modified papers, solvent systems, mechanism of paper chromatography, experimental technique, different development methods-ascending, descending, horizontal, circular spreading, multiple development, two-dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications. Column Chromatography: principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column	migration rates, retention time, and retardation factors. Theoretical aspects such as partition isotherms, Van Deemter equation, height equivalent to a theoretical plate (HETP), and resolution. Chromatographic instrumentation and hyphenated techniques Advanced chromatographic methods and their instrumentation. Theory and operational details of gas chromatography (GC) including column types, temperature programming, and detectors such as thermal conductivity (TCD), flame ionization (FID), electron capture (ECD), nitrogen-phosphorus (NPD), and photoionization (PID) detectors. Principles and applications of GC-MS with emphasis on interface technology, total ion chromatograms, selected ion monitoring, and spectral library searching. Liquid chromatography, the design and operation of high-performance liquid chromatography (HPLC) with detectors such as UV, refractive index (RI), fluorescence, and diode array (DAD). Integration of mass spectrometry with liquid chromatography (LC-MS) and its utility in trace analysis and pharmaceutical applications. Classical and specialized separation methods Physical and chemical separation techniques beyond mainstream chromatography. Methods such as paper chromatography, thin-layer chromatography (TLC), and high-performance TLC (HPTLC) in terms of principles, operational techniques, and applications. Ion exchange chromatography, ion exclusion, and ion chromatography are covered along with their industrial relevance. Gel filtration and molecular sieving using zeolites are introduced for the separation of macromolecules and gases. Electrophoretic techniques, particularly capillary electrophoresis, for high-resolution separation of ionic species. Solvent extraction methods,			
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	chromatography without detectors and liquid chromatography with detectors and applications. Solvent Extraction: principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems, applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid, and surfactant extractions-examples. Capillary Electrophoresis: Principle, Details of the Instrument, Applications to Inorganic and Organic compounds.	including batch, continuous, counter-current, and special cases involving crown ethers, surfactants, and supercritical fluids. Affinity chromatography and counter-current distribution as advanced bio separation techniques. Analytical method development and validation			
17	Applied Chemical Analysis	Analysis of raw materials: Analysis of non-ferrous alloys: Brass - Analysis of the constituents - Cu, Zn, Sn, Pb and Fe. Bronze - Analysis of the constituents -Cu, Sn, Zn, Pb and Fe. Solder - Analysis of the constituents - Sn, Pb and Sb. Analysis of Ferro alloys : Ferro silicon - Analysis of the constituents - Si, C, P, S Ferro vanadium- Analysis of the constituents - V, C, P, S. Si, Al. Ferro manganese - Analysis of the constituents - Mn, S, C, P, Si Silico manganese -Analysis of the constituents -Mn, S, C, P, Si Ferro chromium - Analysis of the constituents - Cr, C, Si. Analysis of Soil, Fertilizer and Fuel: Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humus nitrogen, alkali salts, soil absorption ratio. Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers. Analysis of fuels:	Systematic development and validation of analytical methods. Validation parameters including linearity, accuracy, precision, specificity, robustness, limit of detection (LOD), and limit of quantification (LOQ). Regulatory importance of method validation in pharmaceuticals and industrial quality control. Dissolution testing using USP Apparatus I and II along with sampling strategies for solids, liquids, and gases. Statistical evaluation of analytical data, covering standard deviation, confidence intervals, and the comparison of analytical results using significance tests.	Retained	Retained

					solid fuels-coal, proximate analysis, ultimate analysis, heating value, grading of coal based on Ultimate Heat Value (UHV). ASSESSMENT OF AIR QUALITY: Composition of Pure Air, Classification of Air Pollutants, Toxic Elements Present in Dust, and their Sources – Collection of Air Samples. Sources, Effects, Control of Pollution and Chemical Analysis for the following. Primary Pollutants: Carbon compounds - Carbon monoxide (CO) and Carbon dioxide (CO ₂). Sulphur compounds- sulphur dioxide (SO ₂), Sulphur trioxide (SO ₃) and Hydrogen Sulphide (H ₂ S). Nitrogen compounds - nitric oxide (NO), and nitrogen dioxide (NO ₂), Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAH). Particulate matter - Repairable and Suspended particulate matter, Inorganic and Organic particulates. Secondary pollutants - ozone (O ₃), peroxy acetyl nitrate (PAN), peroxy benzyl nitrate (PBN), Standards for ambient air quality. Kinetic Methods of Analysis & Non aqueous Titrimetry: Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration, extrapolation method for the determination of catalyst, variable time method, fixed time method, examples for the determination of toxic metals and anions using some typical kinetic reactions. Non aqueous titrimetry: Classification of solvents and titrations for non-aqueous titrimetry- Types of reactions – Indicators. Determination of acids Determination of bases Karl-Fisher reagent for the determination of moisture content in drugs and other samples.	
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15/11/2024

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	Vitamins: Terpenoids-Classification of terpenoids, isolation and biosynthesis, Isoprene rule, Structure determination and synthesis of Farnesol, Camphor and Abietic acid, biological significance, and mode of action of forskolin and Taxol; Vitamins: Introduction, chemical properties and structure elucidation of vitamin A, Vitamin B, Ascorbic Acid and Vitamin D. Aromatic Heterocycles: General introduction to heterocyclics and their importance, classification, Nomenclature of ring systems (Hantzsch-Widman System). Synthesis and reactions of indoles, Quinoline, iso quinoline, pyrazole, furan, oxazole, thiophene- Role of heterocyclic compounds in biological systems. Aliphatic Heterocycles and Betaines: Synthesis and reactions of oxetanes, piperidines, epoxides, aziridines, diazirines, thiiranes; Azirines, Oxiranes, Azetidines. Betaines: Formation, aromaticity, and reactivity of pyridine-N-oxides and pyridinium imides. Meso-ionic heterocycles: Synthesis and aromaticity of Sydnones and 1,3-dipolar addition reaction of meso-ionic heterocycles.	methods in structure elucidation (NMR, MS, UV, IR). Chemistry of Terpenoids & Vitamins: Terpenoids-Classification of terpenoids, isolation and biosynthesis, Isoprene rule, Structure determination and synthesis of Farnesol, Camphor and Abietic acid, biological significance, and mode of action of forskolin and Taxol; Vitamins: Introduction, chemical properties and structure elucidation of vitamin A, Vitamin B, Ascorbic Acid and Vitamin D. Mechanistic pathways and biological role in enzymatic reactions, Aromatic Heterocycles: General introduction to heterocyclics and their importance, classification, Nomenclature of ring systems (Hantzsch-Widman System). Synthesis and reactions of indoles, Quinoline, iso quinoline, pyrazole, furan, oxazole, thiophene- Role of heterocyclic compounds in biological systems. Modern synthetic approaches- Catalysis (Pd-catalysis, organo catalysis), Multicomponent reactions. Biological importance and pharmacological activity of aromatic heterocycles. Aliphatic Heterocycles and Betaines: Synthesis and reactions of oxetanes, piperidines, epoxides, aziridines, diazirines, thiiranes; Azirines, Oxiranes, Azetidines. Betaines: Formation, aromaticity, and reactivity of pyridine-N-oxides and pyridinium imides. Meso-ionic heterocycles: Synthesis and aromaticity of Sydnones and 1,3-dipolar addition reaction of meso-ionic heterocycles. Application of green chemistry approaches and modern reagents in heterocycle synthesis.				
21	Open Elective - I	Retained	Retained	-	-	-

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22	VAC	Retained	Retained	Retained	-	-	-
23	Open Elective - 2	Retained	Retained	Retained	-	-	-
24	Dissertation	Retained	Retained	Retained	-	-	-


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ANNEXURE IV

List of Pre-Ph.D. Courses:

LTPS: 4-0-0-0 (For all Courses)

S. No	Paper 1	Subject Code
1	RESEARCH METHODOLOGY	25RES101

S. No	Paper-2		Paper-3	
1	Introduction to Organic Chemistry	25CHE201	Modern Organic Synthesis	25CHE301
2	Analytical Separation Techniques	25CHE202	Modern Instrumental Methods of Analysis	25CHE302
3	Fundamentals of Inorganic Chemistry	25CHE203	Applications in Inorganic Chemistry	25CHE303
4	Chemistry of Nanomaterials	25CHE204	Applied Electrochemistry	25CHE304
5	Principles of Environmental Science	25CHE205	Water Management Techniques	25CHE305
6	Basics of Physical Chemistry	25CHE206		


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25RES101: RESEARCH METHODOLOGY

LTPS: 4-0-0-0

UNIT I – Introduction to Research

This unit introduces the fundamental concepts of research, including its definition, objectives, and scope. It covers various types of research such as qualitative, quantitative, mixed methods, experimental, case study, comparative, longitudinal, and cross-sectional approaches. The steps in the research process are explained, along with strategies for identifying and defining a research problem. Emphasis is placed on conducting an effective literature review by using subject-specific databases such as Scopus, Web of Science, PubMed, JSTOR, AGRICOLA, and HeinOnline. The unit also addresses research ethics, including plagiarism, authorship, data integrity, and adherence to professional codes of conduct such as APA, MLA, ICMJE, and discipline-specific ethical guidelines.

UNIT II – Quantitative and Qualitative Methods

This unit focuses on both quantitative and qualitative research methods. Quantitative methods include statistical modeling, probability distributions, sampling techniques, hypothesis testing, regression, ANOVA, correlation, and multivariate analysis. Qualitative methods include interviews, focus groups, case studies, ethnographic research, and content or discourse analysis. The mixed-methods approach, which combines both quantitative and qualitative strategies, is also discussed. Concepts of error analysis, data reliability, and validity are introduced, along with examples of how these methods are applied across disciplines such as the sciences, social sciences, humanities, law, management, and other non-engineering fields.

UNIT III – Data Collection, Presentation, and Analysis

This unit examines the collection, organization, and presentation of research data. It discusses primary and secondary sources of data and outlines various tools and techniques for data collection, including surveys, experiments, observations, and archival research. Methods for presenting data in tabular and graphical form are explained, including tables, charts, histograms, scatter plots, and thematic maps. The unit also covers the preparation of datasets for analysis and the interpretation of research results. Software tools such as Excel, SPSS, R, NVivo, Atlas.ti, and other discipline-specific platforms are introduced to enhance data analysis capabilities.

UNIT IV – Digital Tools and Soft Computing in Research

This unit explores the role of computers and digital tools in modern research. It covers statistical analysis software such as SPSS, R, GRETL, MATLAB, STATA, and NVivo, as well as reference management tools like Mendeley, Zotero, and EndNote. An introduction to artificial intelligence and machine learning applications in research is provided, including text mining, image analysis, and predictive modeling. The unit also gives an overview of evolutionary algorithms, fuzzy logic, and neural networks, with emphasis on their applicability in non-engineering disciplines. The use of GIS, remote sensing, and other domain-specific tools is also addressed where relevant.

UNIT V – Research Communication and Report Writing

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This unit focuses on the effective communication of research findings. It explains the structure and components of a research report, dissertation, or thesis, and describes the various types of research reports, including empirical, theoretical, review, case study, and policy documents. Guidelines for formatting according to styles such as APA, MLA, Chicago, IEEE, and OSCOLA are provided, depending on disciplinary requirements. The unit also covers writing abstracts, literature reviews, methodology, results, and discussions, as well as citation ethics and plagiarism avoidance. Finally, it discusses preparing papers for conferences and journals, and delivering research presentations through posters, PowerPoint slides, and online dissemination platforms.

Textbooks

1. C.R. Kothari, Research Methodology: Methods and Techniques, 2/e, Vishwa Prakashan, 2006
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 4th Edition, SAGE Publications, 2014

Reference Books

1. John W. Creswell & J. David Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition, SAGE Publications
2. Alan Bryman, Social Research Methods, 5th Edition, Oxford University Press
3. Uwe Flick, An Introduction to Qualitative Research, 6th Edition, SAGE Publications
4. Donald H. McBurney, Research Methods, 5th Edition, Thomson Learning

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Paper-2 Syllabus

Introduction to Organic Chemistry

LTPS: 4-0-0-0

UNIT- I: Purification and drying of organic solvents Benzene, toluene, xylene, Tetrahydrofuran, chloroform, dichloromethane, methanol, dimethyl formamide, dimethylsulfoxide,

Preparation of Reagents: Sodium methoxide, TMEDA-ZnCl₂ Complex, Lithium diisopropylamide, Butyl Lithium, organomagnesiumhalide, wittig reagent, sodamide, dialkylolithiumcuprate. Oxidising agents, Reducing agents.

UNIT- II: Named reactions and rearrangements Benzoin condensation, Perkin reaction, Cannizaro reaction, Diels Alder reaction, Hetero diel's alder reaction, Peterson olefination, Wolf Kishner reduction, Claisen rearrangement, Cope rearrangement, Oxycope rearrangements, Benzidine rearrangement, Beckman rearrangement.

UNIT-III: Transition metal complexes in organic synthesis – Applications of Organo Palladium compounds, Rhodium complexes, Metal carbonyl complexes of Fe, Co and Ni.

UNIT-IV: Emerging greener methodologies: Sonochemistry and green aspects; Microwave in chemical synthesis: Basic principles, advantages, and examples; Electrochemical synthesis: concepts and examples.

UNIT- V: Chromatographic techniques: Principles & applications with respect to Thin-Layer chromatography, Paper chromatography, Column chromatography, Gas Chromatography and HPLC with suitable examples & Chromatograms

Reference books:

1. Mike Lancaster, 2002, Green Chemistry: An Introductory Text, Royal Society of Chemistry.
2. Nina Hall (Editor-in-chief), 2000, The New Chemistry, Cambridge university Press.
3. M.B. Smith & Jerry March 2001, March's Advanced Organic Chemistry, 5th Edition, John Wiley & Sons, New York.
4. J. Clayden, N. Greeves, S. Warren, and P. Wothers, 2001, Organic Chemistry, Oxford University press INC, New York.

Analytical Separation Techniques

LTPS: 4-0-0-0

Unit- I: Basic Separation Techniques: Theory and Techniques of distillation, fractional distillation, steam distillation, vacuum distillation, Molecular distillation, and sublimation. Theory of action of drying agents, Fractionation by evaporation-working of Rotary film

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evaporator. Extraction-Distribution law and derivation, solvents and their choice. Techniques- batch and continuous, multiple extractions. Complexation-Theory and application of complexing agents and choice. Dialysis-Theory, membranes, and their choice, techniques, and applications. Ultrafiltration and zone filtration – principles and techniques. Centrifugation- Principle, Techniques, Ultra centrifuge-description of apparatus, theory, sedimentation velocity, and molecular weight determination.

Unit-II: Fundamentals of Chromatography: Classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis. Principles of chromatography, different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm. Dynamics of chromatography-efficiency of the chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Deemter equation, resolution, choice of the column, length, and flow velocity. Column chromatography (adsorption chromatography): principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase).

Unit-III: Basic Chromatographic Techniques: Column chromatography-Construction and operation of the column, choice of adsorbents and eluents, techniques of elution, methods of detection, analytical and industrial applications. Paper chromatography-principle, papers as a chromatographic medium, modified papers, solvent systems, mechanism of paper chromatography, experimental technique, different development methods-ascending, descending, horizontal, circular spreading, multiple development, two-dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications. Thin Layer chromatography- principle, Ion Exchange: principles of ion-exchange systems, ion-exchange mechanism. Ion exchange chromatography: Principle, Equipment, Application. Ion chromatography: principles of separation, instrumentation, detectors, separation of cations and anions.

Unit-IV: Modern Separation Techniques: I Exclusion (Gel) Chromatography: Instrumentation, sources of errors, GPC calibration, Column packing, Theory of size of exclusion chromatography, Application of size exclusion chromatography (GPC). Supercritical Fluid Chromatography: Properties of Supercritical Fluid (SFC) –Instrumentation and operating variables, Comparison with other types of chromatography (HPLC and GLC), Applications. Capillary Electrophoresis and Electrochromatography: Over view of Electrophoresis, Capillary Electrophoresis, Applications of Capillary Electrophoresis and Capillary electrochromatography.

Unit-V: Modern Separation Techniques: II Gas Chromatography: Principles of gas chromatography, plate theory of gas chromatography, Instrumentation for gas chromatography, working gas chromatography, Evaluation of gas chromatogram, Identification of gas chromatogram, programmed temperature chromatography, flow programming chromatography (FPC), gas-solid chromatography, application of gas chromatography. High-Performance Liquid Chromatography: Introduction, Instrumentation, Refractive index detector, luminescence detector, ultraviolet detector, and electrochemical detector, Quantitative analysis, and data display, Derivatisation technique in HPLC, Chiral columns, C8 and C18 columns, Applications. HPTLC-principle, technique, applications. Plasma

VK 14/5/2020
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chromatography, supercritical fluid chromatography.

TEXT BOOKS:

1. Techniques and practice of Chromatography by R.P.W Scott, Marel Dekker Inc., New York
2. Separation methods by M.N. Sastri, Himalaya Publishing Company, Mumbai

REFERENCE BOOKS:

1. Chromatography by E. Helfman, Van Nostrand and Reinhold, New York
2. Chromatography by E. Lederer and M. Lederer, Elsevier, Amsterdam.
3. Chemical separation methods by John A Dean, Von Nostrand Reinhold, New York
4. Techniques and practice of Chromatography by R.P.W Scott, Marel Dekker Inc., New York
5. Basic Gas Chromatography by H.M Mc Nair and J. M. Miller, John Wiley, New York
6. Analytical Gas Chromatography by W. Jeumings, Academic Press, New York
7. Practice of HPLC by H. Eugelhardt (ed), Springer Verrag, Berrin

Fundamentals of Inorganic Chemistry

LTPS: 4-0-0-0

UNIT I: Chemistry of main group elements: Recent advances and general trends in properties – Chemical periodicity, Boron hydrides, carboranes, metallocarboranes, intercalation compounds, nitrogen – phosphorous compounds, boron-nitrogen compounds, sulphur – nitrogen cyclic compounds, interhalogen and pseudohalogens.

UNIT II: Chemistry of Transition elements: Relationship of structure, reactivity, electronic and magnetic properties of 3d, 4d, 5d elements. Chemistry of lanthanides and actinides, magnetic and optical properties. Difference in properties compared to d-block elements, Metal cluster compounds (structure, bonding and reactivity). Applications of transition metals.

UNIT III: Coordination compounds: Crystal field theory (CFT) – Crystal field splitting patterns in Octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Factors affecting crystal field splitting energies, Spectrochemical series, Jahn – Teller effect, nephelauxetic effect, ligand field theory, Term symbols and Spectroscopic states.

UNIT IV: Metal clusters and organo-transition metals – Metal-metal bond, carbonyl clusters -low dimensional solids, Transition metal to carbon bonds, Complexes with π -acceptor, and σ -donor ligands -18e and 16e rule complexes – Examples, Isolobal analogy, Application of Wades rule.

UNIT V: Metal Ligand Equilibria in solution: Stepwise and overall formation constants, factors affecting formation constant – chelate effect – Determination of formation constants by Spectrophotometric method (Job's) and pH metric method (Bjerrum's). Stability correlations - Irving – William's series, Theory of Acids and Bases, Bronsted and Lewis acids and bases, hardness and softness (HSAB principle), Macrocyclic effect - Crown ethers and Cryptates.

Text Books

VU
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1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Inorganic Chemistry by Shriver and Atkins, Oxford University Press, 5th edition.
4. Concise Inorganic Chemistry by J.D. Lee, Oxford University Press; Fifth edition, Wiley India edition.

Reference Books

1. Inorganic chemistry by Sharpe and Housecroft, Fourth edition, Pearson.
2. Lehninger Principles of Biochemistry by David L. Nelson, Michael M. Cox, Fourth edition, W H Freeman & Co; Pck edition.

Chemistry of Nanomaterials

LTPS: 4-0-0-0

Unit-I Fundamentals of nanomaterials: Introduction, Definitions, Historical development of nanomaterials, Classification of nanomaterials, Size & Scale Units Scaling Atoms, Molecules, Clusters and Supramolecules, Structure and Bonding in Nanomaterials Chemical Bonds (types and strength) Intermolecular Forces Molecular and Crystalline Structures Hierarchical Structures Bulk to Surface transition, surface reconstruction, Self-assembly and thermodynamics, Properties and Size dependence of properties: Chemical, Optical, vibrational, thermal, Electrical, Magnetic, Mechanical, Theoretical Aspects-e.g. density functional theory.

Unit-II Nanomaterial Synthesis: Chemical routes, Electrochemical methods, Vapor growth, Thin films methods: chemical vapor deposition, physical vapor deposition, (sputtering, laser ablation), Langmuir-Blodgett growth, Mechanical methods: ball milling, mechanical attrition, Sol-gel methods, Special nanomaterials: carbon nanotubes, fullerenes, nanowires, porous silicon, Bio-inspired synthesis, Nanocomposite fabrication, Nanolithography.

Unit-III Nanoporous materials and quantum dots: Micro, Meso, and Macroporous materials, methods of synthesis, different additions in nanoporous materials. The surface area of porous materials and its determination. Thermogravimetric studies of nanoporous materials. Quantum dots, mechanism based on bandgap, excitons, quantum confinement effect, Bohr's radius in quantum dots.

Unit-IV Nanoparticles characterization techniques: Scanning and Transmission Electron Microscopy, Scanning Probe Microscopies: Atomic Force, scanning tunneling microscopy, Diffraction and scattering techniques, Vibrational spectroscopy, Surface techniques.

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Unit-V Applications: Nano-electronics, Nano optics, Nanoscale chemical- and bio-sensing, Biological/bio-medical applications, Photovoltaic, fuel cells, batteries, and energy-related applications, High strength nanocomposites, Nanoenergetic materials

Textbook

1. The Physics and Chemistry of NanoSolids by Frank J. Owens and Charles P.
2. Poole Jr, Wiley-Interscience, 2008.

Reference Books

1. Nanomaterials- Synthesis, Properties and Applications, Edited by A.S. Edelstein and R.C. Cammarata, Institute of Physics Publishing, London, 1998 (paper back edition)
2. Nanochemistry: A Chemical Approach to Nanomaterials, by G. Ozin and A. Arsenault, RSC Publishing, 2005
3. Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, Edward L. Wolf, Wiley-VCH, 2nd Reprint (2005)

Basics of Physical Chemistry

LTPS: 4-0-0-0

Unit-1: Chemical Kinetics: Fast reactions; Rate constants of fast reactions; Their determination by Stopped flow method, Relaxation method, Flash photolysis and Nuclear Magnetic Resonance methods. Ionic reactions; Influence of solvent on the rate of reactions (single & double sphere A.C. model); Primary salt effect; Secondary salt effect; Influence of frequency factor; Influence of ionic strength.

Unit-2: Catalysis: Types of Catalytic Reagents; Types of Catalysis (Homogeneous and Heterogeneous catalysis); Catalytic activity; Acidity Functions; Theory of Homogeneous catalysis; Theory of Heterogeneous catalysis (Chemical theory & Adsorption theory); Kinetics of heterogeneous reactions.

Unit-3: Enzyme Catalysis and Surface Chemistry: Specificity in Enzyme Catalyzed reactions; Michaelis-Menten mechanism; Influence of Concentration on Enzyme-Catalyzed reactions; Influence of Temperature on Enzyme Catalyzed reactions; Acid-base catalysis. Adsorption; Factors influencing adsorption; Surface area and its measurements; Adsorption isotherm curves; Langmuir's adsorption isotherm-its limitations; B.E.T. Adsorption isotherm-its applications; Negative adsorption; Positive adsorption; Chemisorption; Physisorption and Determination of surface area.

Unit-4: Quantum Mechanics: Introduction to Quantum Mechanics: Postulates of Quantum Mechanics; Schrödinger wave equation; Physical significance of wave function; Eigen values and Eigen functions; Particle in a box (one dimensional) behavior; Normalization; Orthogonality; Degeneracy.

Unit-5: Photochemistry: Types of Photochemical reactions; Laws of Absorption (Grothuss-Draper law & Einstein's law); Quantum yield; Primary & Secondary Photochemical processes; Joblonski Diagram: Fluorescence, Phosphorescence, Inter-System Crossing; Internal

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Conversion-Vibrational Cascade and Chemiluminescence. Kinetics of Photochemical reactions; Dissociation of HI; Reaction between Hydrogen and Chlorine; Reaction between Hydrogen and Bromine; Reaction between Hydrogen and Oxygen; Explosion limits.

Text Books & Reference Books

- 1) Chemical Kinetics By K.J. Laidler, Pearson Education India; 3 Edition (2003)
- 2) An Introduction To Chemical Kinetics, Michel Soustelle, Wiley , First Edition (2011)
- 3) Atkins' Physical Chemistry: Peter Atkins , Julio De Paula , James Keeler, Oxford University, Press, 11th Edition (2018).
- 4) Advanced Physical Chemistry, Gurudeep Raj, Krishna Prakashan Media P. Ltd., 4th Edition (2016).

Principles of Environmental Science

LTPS: 4-0-0-0

UNIT I Ecology, Environment and Energy Resources: Principles of ecology; ecosystem-structure and functions; biomes and biodiversity; biogeochemical cycles; environment-management and pollution; sustainable development; inter and intra-species relationship, Major ecosystems of world-arctic, tundra, northern coniferous forests, temperate forests, grassland deserts, tropical rain forests, fresh water, and marine ecosystems. Ecology of population community, succession and fluctuation dynamics of ecosystem. Environment-definition and concepts. Components of environment-atmosphere, hydrosphere, biosphere, pedosphere and their interaction. Ecological successions: Energy resources- renewable and non-renewable.

UNIT II Environmental Chemistry, Environmental Health and Toxicology: Environmental segments- atmosphere, hydrosphere, lithosphere; Chemical interactions; Toxic chemicals in environment; environmental health hazards; Biochemical effects- arsenic, lead, mercury, carbon monoxide, nitrogen oxides, sulfur dioxide, ozone and PAN, cyanide, pesticides; Measuring toxicity and Risk assessment. Environmental monitoring: Introduction concepts and Importance. Monitoring systems - physical, chemical and biological, monitoring tools –

UNIT III Air Pollution & Control Technologies: Air pollution- types and sources; Air pollutants- classification and properties; Meteorological aspects of air pollution; Air pollution-sampling and measurement; Control methods- particulate and gaseous emissions; Automobile

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pollution. Role of different gases, particulates, heavy metals and pesticides in environmental pollution. Sampling and analysis techniques of monitoring pollution

UNIT IV EIA, Environmental Law and Policy Concept of EIA; EIA methodologies; Impact prediction and assessment-air, water, biological, socio-economic; Concepts of Environmental Audit; Environmental education; Environmental Policy; Environmental Law and regulations; Citizen participation.

UNIT V Solid and Hazardous Waste Management: Waste-definition and types; Generation; Collection; Segregation; transport; Treatment; Disposal Methods; Waste Processing and management; Creation of TSDF; Impacts of waste; legal and administrative regulations: problems associated with waste disposal; Impact on air, water and soil. Waste processing; physical, chemical, and biological methods; landfilling operations and its impact on water and agriculture. Hazardous wastes and their disposal.

Reference books:

1. Ecology- E.P. Odum, 1983, Holt-Saunders International Edition
2. Environmental Chemistry- A.K. De, New Age Intt. Pub. Co., New Delhi, 1990
A Text Book of environmental – C.S. Rao, Wiley Eastern Limited., 1993

Paper-3 Syllabus

Modern Organic Synthesis

LTPS: 4-0-0-0

1. Synthetic strategies and Asymmetric synthesis. Design of Organic synthesis: Terminology, Retrosynthesis, FGI, disconnection, synthon synthetic equivalent, protecting groups, chemoselectivity, regioselectivity and stereoselectivity. Linear and convergent strategies, Use of disconnection approach in the synthesis of multistriatin, Warfarin and α -bisabolene.
2. IR Spectroscopy: Introduction, Principles, Characteristic vibrational frequencies of functional groups, Fermi resonance, Effect of hydrogen bonding on vibrational frequencies. ii) Electronic spectroscopy: Introduction, Principles and Woodward-Fieser rules. iii) NMR Spectroscopy (^1H NMR): Introduction, Principles, factors effecting the chemical shifts, spin-spin coupling, first order spectra. iv) Mass Spectrometry: Introduction, Principles, use of isotopic peaks, salient feature of fragmentation of organic compounds, McLafferty rearrangements, retro Diels-Alder fragmentation and ortho effects. Simple problems on structure determination based on the above spectral methods.
3. Modern Concepts of Organic Chemistry and Green Chemistry: a) New Techniques and concepts in organic synthesis. i) Combinatorial synthesis ii) Tandem synthesis iii) *no*

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Mosher's method for configuration determination iv) Baldwin rules v) Kahne's glycosidation vi) Methods of oligonucleotide synthesis. b) Green Chemistry: Introduction, principles of green chemistry, Different approaches to green synthesis: Microwave and Ultrasound assisted organic synthesis, Solid phase and aqueous phase organic synthesis.

4. Transition metal complexes in organic synthesis – Applications of Organo Palladium compounds, Rhodium complexes, Metal carbonyl complexes of Fe, Co and Ni. Phase transfer catalysts – Application of phase transfer catalysts in organic synthesis with reference to Tetraalkylammonium, Tetraalkylphosphonium, Trialkylsulphonium salts and Crown ethers.

Text books:

1. Spectroscopic identification of organic compounds by RM Silverstein, G C Bassler and T B Morrill
2. Organic Spectroscopy by William Kemp
3. Spectroscopic methods in Organic chemistry by DH Williams and I Fleming
4. Modern NMR techniques for chemistry research by Andrew B Derome
5. Advanced organic chemistry part A and Part B by F.A. Carey and R.J. Sundberg, Springer, 2007
6. Some modern methods of organic synthesis by W. Carruthers, Cambridge University press 4 th edition, 2012

Modern Instrumental Methods of Analysis

LTPS: 4-0-0-0

Unit-I UV-Vis spectroscopy and Atomic Absorption spectroscopy: Brief review of the electromagnetic spectrum, UV-Visible range, energy-wavelength-color relationships, Interaction of electromagnetic radiation (UV-Vis) with matter and its effects, Chromophores, auxochromes, bathochromic, hypochromic, hypsochromic, hyperchromic shifts. Calculation of λ_{max} . Woodward-Hofmann rules for conjugated dienes and α,β -Unsaturated carbonyl compounds, Electronic Spectra of diatomic molecules, the vibrational structure of an electronic transition, classification of bands, rotational fine structure of electronic vibrational transition. Electronic Spectra of Polyatomic Molecules- Instrumentation-Applications. Chiroptical spectroscopy-CD, ORD curves, applications to organic molecules. Problems related to UV and ORD curves. **Atomic Absorption spectroscopy:** Introduction and importance; Principles and instrumentation; Interferences - Chemical & Spectral and evaluation methods; Applications of Atomic Absorption Spectroscopy for qualitative and quantitative analysis.

Unit-II Infrared and Raman Spectroscopy: Introduction; basic principles; Instrumentation; Detectors, Qualitative, Quantitative analysis and Applications. Raman spectroscopy: Classical and quantum theories of Raman effects, pure rotational, vibrational and Vibrational – rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent anti-stokes Raman Spectroscopy (CARS)-Application. Raman spectroscopy – identification of some organic functional groups. Solving some problems related to IR and Raman spectroscopy.

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Unit-III Nuclear magnetic resonance spectroscopy: Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing, coupling constant J. Classification (ABX, AMX, ABC, A2, B2 etc.). ¹³C NMR –Principle, rules, applications, and problems. 2D NMR – Principle, COSY (HETCOR, HOMCOR) DQFCOSY, DEPT, INEPT, NOESY, INADEQUATE, HMBC, HMQC, and problems.

Unit-IV Mass Spectrometry and Thermal methods: Introduction; Basic principles, ionizing sources, types of ions, detectors, and applications. Rules, modes of fragmentation of various organic molecules, and problems. Principle and applications of GC-MS, HPLC-MS, GC-FTIR. Principles, basic instrumentation, and applications of TG, DTA, and DSC.

Unit-V Fluorescence, radiochemical and electrochemical methods: Theory of fluorescence, phosphorescence, factors affecting the above, quenching, the relation between the intensity of fluorescence and concentration, instrumentation, application. Chemiluminescence, Electro-chemiluminescence. Principle, energy dispersive X-ray fluorescence, wavelength dispersive X-ray fluorescence, X-ray photoelectronic spectroscopy, chemical shift, application of XPES and XRF. Introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis, activation analysis – application. Cyclic voltammetry and differential pulse voltammetry– Principle, instrumentation, and applications.

TEXT BOOKS:

- 1) Instrumental methods of analysis by H.H Willard, Meritt Jr. and J.A Dean
- 2) Principles of instrumental analysis by Skoog and West
- 3) Vogels Textbook of Quantitative Inorganic analysis by J. Basset, R.C Denney, G.H Jefferey and J.Madhan
- 4) Instrumental methods of analysis by B.K Sarma, Goel Publishing House, Meerut
- 5) Instrumental methods of Analysis by Chatwal and Anand
- 6) Instrumental methods of Analysis by Ewing

REFERENCE BOOKS:

- 1) Introduction to instrumental analysis by R. D. Braun, Mc Graw Hill - International edition.
- 2) Analytical spectroscopy by Kamallesh Bansal, 1st edition.
- 3) Instrumental methods of chemical analysis by Willard, Dean and Merittee- 6th edition.
- 4) Analytical chemistry principles by John H. Kenedey- 2nd edition, Saunders college publishing.
- 5) Spectroscopic identification of organic compounds Fifth Edition by Silvestrine, Bassler, Morrill, John Wiley and sons.
- 6) Analytical Chemistry by Kellner; Mermet, otto, Valcarcel, Widmer, Second Ed. Wiley –VCH

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Applications in Inorganic Chemistry
LTPS: 4-0-0-0

UNIT I

Electronic Spectra of transition metal complexes – Selection rules, break-down of selection rules – Orgel and Tanabe-Sugano diagrams for d1 – d9 octahedral and tetrahedral transition metal complexes of 3d series – Calculation of Dq , B and β parameters. Charge transfer spectra. Magnetic properties of transition metal and inner transition metal complexes – spin and orbital moments, quenching of orbital momentum by crystal fields in complexes. Interpretation of UV-Visible spectra of transition metal complexes.

UNIT II

Inorganic Reaction Mechanisms: Substitution, anation and hydrolysis reactions, Inert and labile complexes- associative, dissociative and interchange mechanisms-ligand substitution reactions in Square planar and octahedral complexes –Trans effect. Electron transfer reactions –outer-sphere and inner-sphere mechanisms. Correlation of rates with structure and electronic configuration. Molecular rearrangements –Berry pseudorotation–fluxional molecules. Applications.

UNIT III

Bioinorganic Chemistry: Na^+ - K^+ Pump, ionophores, Biochemistry of iron -its storage, transport and function- Ferritin, Transferrin, Siderophores and metallothionein. Electron Transfer: Cytochromes, Iron-Sulfur Proteins and Copper Proteins. Oxygen transport and storage: Hemoglobin, myoglobin, hemerythrin, hemocyanin,

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photosystems, enzymes, coenzymes and metalloenzymes, nitrogen fixation, metal complexes in biological/biomedical applications.

UNIT IV

Organometallics in catalysis: Hydrogenation, hydroformylation, acetic acid synthesis, metathesis and olefin oxidation, Fischer-Tropsch reaction, Ziegler Natta Polymerization, Organometallic catalysts in organic reactions – Coupling reactions: Suzuki, Stille, Negishi, Sonogashira reactions.

UNIT V

Solid State Chemistry: Bonds in Solids – chemical and physical bonds, influence of the bonds on properties, Braggs Law – Crystal structure, Crystal defects and their influence on materials properties, non-crystal matter – amorphous, valence and conduction bands, Band theory of solids, Synthesis and preparation of materials, material properties – chemical, thermal, mechanical, electrical, dielectric, optic, magnetic, basic methods for characterization of solid matter – electron microscopy and diffraction, x-ray diffraction, thermal analysis, spectroscopic methods. Applications of solid-state materials.

Text Books

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Inorganic Chemistry by Shriver and Atkins, Oxford University Press, 5th edition.
5. Concise Inorganic Chemistry by J.D. Lee, Oxford University Press; Fifth edition, Wiley India edition.

Reference Books

1. Inorganic chemistry by Sharpe and Housecroft, Fourth edition, Pearson.
2. Lehninger Principles of Biochemistry by David L. Nelson, Michael M. Cox, Fourth edition, W H Freeman & Co; Pck edition.

Water Management Techniques

LTPS: 4-0-0-0

UNIT I: Water Pollutants and Water Treatment:

Water Pollution: Water Physical and chemical properties, Sources, Eutrophication and Water and quality standards. Types of Pollutants, Sampling, and preservation of water. Analysis of the following in the Drinking water; Hardness, Alkalinity, DO, BOD, COD, Chlorides ammonia, Nitrate and Nitrite, Sulphate; Phosphate, Metals like – Fe^{2+} , Mn^{2+} , Pb^{2+} , Ni^{2+} and Cr(VI) and Organics – Phenol. Types and Sources, Heavy metals- metalloids- organic- inorganic- biological- radioactive pollutants, Methods of Water treatment- sedimentation- flotation, secondary (biological) treatment- design and principles in biological treatment facilities- activated sludge process- trickling filters – tertiary treatment

UNIT II

Industrial Waste Water Treatment: Sources, Characteristics, methodology and process for the treatment of industrial wastes of sugar industry- beverage industry- tannery industry-

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textile mill waste industry- fertilizer plant- steel plant- oil refinery- pharmaceutical [plant- paper and pulp mill]

UNIT III

Advanced Wastewater Treatment: Introduction, removal of suspended solids- removal of dissolved solids- Ammonia removal- phosphorous removal- chemical oxidation- recovery of materials from process effluents. low-cost waste treatment systems and their design,

UNIT IV

Sewage Treatment and Disposal: Self-purification of streams- BOD and its importance- treatment methods- primary, secondary and tertiary levels- disinfections of treated sewage effluent- septic tank design- effluent disposal methods- disposal on land, sewage sickness- disposal by dilution- design of biological treatment units- sludge characteristics, unit operations in sludge disposal, conventional and high rate digesters- disposal of sludge- gas utilization.

UNIT V

Phytoremediation Treatment: Introduction, current trends in role of phytoremediation- examples of species potential in absorbing heavy metals and pollutants in waste water- root zone treatment technology- microbial remediation- role of bacteria and the microbes in cleaning of sewage waters- oil spilled waters- domestic waste waters- polluted agricultural runoff- bio medical waste retaining waters. Chemical Toxicology: Bio chemical effects of the following, Calcium, Lead, Mercury, Arsenic, Cyanide, Pesticides, Carbon monoxide, Nitrogen oxide and Sulphur dioxide.

Text Books:

1. Water Supply and Sanitary Engineering, G.S. Birdie & J.S. Brides, Dhanpat Rai & sons 1993.
2. A treatise on Rural, Municipal, and industrial waste management KVSG Murali Krishna
3. Environmental Sanitation (Social and preventive medicine) Dr. P.V. Rama Raju & KVSG Murali Krishna
4. Waste water engineering, treatment and reuse by Metcalf and Eddy, fifth edition, Tata Mc Graw Hill.

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Applied Electrochemistry

LTPS: 4-0-0-0

Unit-I Electrodictics: Basics of electrodictics, rates of simple electrode reactions, elementary electron electrode process, Butler-Volmer equation, exchange current density and symmetry factor, experimental determinations, electrode rectification, Nernst equation as a special case of the Butler - Volmer equation, reaction resistance, polarisable & non-polarisable electrodes, low and high field approximations, Tafel equations. Examples of multi-electron reactions, Butler-Volmer equation for a multi-step reaction, the concept of the rate-determining step of an electrode reaction, current potential laws for electrochemical systems. Types of overvoltages, chemical and electrochemical overpotentials, phase, activation and concentration overpotentials, diffusion, migration, and hydrodynamic modes of transports, the role of supporting electrolyte, theory of diffusion over potential, reactions at an electrode, three-electrode system, sign conventions, rates of electrochemical reactions, overpotential, electrocatalysis, electrogrowth of metals, hydrogen evolution reactions, electronation of oxygen.

Unit-II Electrodeposition and corrosion: Factors affecting electrodeposition of metals, Simultaneous discharge of cations, depolarisation of metal deposition, separation of metals by electrolysis. Electrochemical passivity, Passivity and current density, chemical passivity, theories of passivity, Electroplating. Corrosion: The corrosion of metals, hydrogen evaluation type, and differential oxygenation type corrosion. Corrosion inhibition. Electrochemical theory of Corrosion. Corrosion testing. Materials and specimens, Surface propagation, Gravimetric method, measuring and weighing, exposure techniques. Planned interval tests. Corrosion rate determination at short time intervals.

Unit-III Electrochemical Techniques: Linear sweep voltammetry, Differential pulse voltammetry, Stripping voltammetry: Anodic stripping, cathodic stripping, adsorptive stripping voltammetry, Principles, and applications. Cyclic voltammetry: Principles and Applications, Applications of impedance measurements, Potentiodynamic polarization studies, Tafel method, Rotating disk, and ring disk electrodes and Applications. Principles, Instrumentation, and Applications. Chronomethods: Principles, Chrono-potentiometric - amperometric and - coulometric measurements, Instrumentation, and Applications. Electrochemical scanning tunneling microscopy. Spectro-electrochemistry principle and applications.

Unit-IV Electrochemical Sensors (Chemically Modified Electrodes): Biosensors, catalytic sensors, and gas sensors. Enzyme electrodes, preparation & properties of modified electrodes eg, Nafion modified electrode, PVP modified electrode. Applications such as Electrocatalysis, ion-selective electrodes. Introduction, formation of monolayers of organic molecules on electrodes. Bioelectrochemistry: bioelectrodictics, membrane potentials, electrochemical communication in biological organisms Different electrodes of carbon as electrode material: Glassy corban electrode, carbon fibre electrode, carbon paste electrode, and carbon nano-tube paste based electrode and their applications.

Unit-V Battery Technology and Environmental Electrochemistry: basic concept, classification of batteries, primary, secondary, and reserve batteries, Construction, working, and application of Acid Storage batteries, Lithium -MnO₂ batteries, Nickel- Metal hydride batteries, Fuel Cells, Construction and working of H₂O₂ and methanol-O₂ Cell. Chemical-Hydrogen production and storage, Principle of direct energy conversion using fuel cells, thermodynamics of fuel cells, Types of fuel cells, AFC, PEMFC, MCFC, SOFC, Microbial fuel cell, Fuel cell performance. The solar-hydrogen solution. The CO₂ fixing, Photo-electrochemical reduction of CO₂, the photoelectrochemical splitting of water. Electrochemical removal of wastes: (i) Wastewater (ii) Sulphur dioxide (iii) Removal of metals (iv) Destruction of nitrates. Electrochemical treatment of low-level nuclear wastes.

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Textbooks

1. J.O.M. Bockris and A.K.N. Reddy, Modern Electrochemistry, Volumes 1 & 2, Plenum Press, New York. 1988.
2. S.Glasstone, Electrochemistry, Affiliated East-West Press, Pvt., Ltd., New Delhi, 1974.
3. A.J.Bard and L.R. Faulkner, Electrochemical methods –Fundamentals and Applications,,2nd Ed., John Wiley and Sons, 2001.
4. C.Hamann, A. Hamnett and W. Vielstich, Electrochemistry, Wiley, 2007

References

1. D.A.McQuarrie and J.D.Simon, Physical Chemistry-A Molecular Approach, Viva Books Pvt. Ltd., New Delhi, 1999.
2. J.Rajaram and J.C. Kuriakose, Kinetics and Mechanism of Electrochemical Transformations, Macmillan India Ltd., New Delhi, 1993.
3. R.J Gale, Spectroelectrochemistry, Wiley 2010.


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DEPARTMENT OF CHEMISTRY

A.Y:2024-2025

KLEF/ CHEM / IQAC - ACADEMICS/ DC Meetings (DAC)/ AQ 8.2

03.05.2025

The DAC meeting was conducted on 3rd May 2025 at 2:00 PM in F204B.

Agenda:

1. To review and approve the Y25 program structure.
2. To review and approve the revised syllabus for Y25 admitted batch.
3. To review and approve the addition of new courses to Y25 program structure.
4. To review and approve the stakeholder feedback.
5. Any other item with the permission of the chair.

The meeting started with an address by Dr. A Venkateswara Rao (HOD, Chemistry Department) extending a warm welcome to the department academic Committee members present for the meeting.

The following points were discussed and resolved:

Agenda 1: To review and approve the Y25 program structure.

Discussion: The committee examined the program structure for Y25 admitted batch. Suggestions were made regarding the offering of courses in different semesters. All feedback was discussed and addressed appropriately.

Resolution: The proposed program structure was approved. It is resolved to implement the same program structure for Y25 also with change in offering of courses. The finalized Y25 program structure is given under the annexure I and the same is recommended for approval in BOS.

Annexure I: Finalized Y25 program structure.

Agenda 2: To review and approve the revised syllabus for Y25 admitted batch.

Discussion: The revised syllabus of the courses is presented and reviewed by the committee. Members confirmed the need to revise the syllabus. No corrections were suggested.

Resolution: The following resolutions were made considering the stakeholder feedback:


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1. It is resolved to add the new topics to module 1 of the symmetry and molecular spectroscopy course (25CY5101)
2. It is resolved to add the new topics to module 2 and 4 of the structural organic and stereochemistry course (25CY5103)
3. It is resolved to add the new topics to module 1, 2 and 4 of the biomolecules course (25CY5207)
4. It is resolved to add the new topics to all the modules of the concepts of organic synthesis course (25CY5221)
5. As per the stakeholder feedback it is resolved to merge the separation techniques and chromatographic methods & validation techniques courses. The revised syllabus is approved under the course title "Advanced Separation and Chromatographic Techniques (25CY61E3)" as professional elective.
6. It is resolved to add the new topics to module 1, 3 and 4 of the course Nano chemistry (25CY61E5)
7. It is resolved to add the new topics to all the modules of the course Natural products and heterocyclic chemistry (25CY61E8)

Annexure II: Revised syllabus for Y25 admitted batch.

Agenda 3: To review and approve the addition of new courses to Y25 program structure.

Discussion: The committee reviewed the proposal of adding new course "Food analytics and Quality Assessment". Considering the stakeholder feedback, the addition of new course to Y25 structure is approved.

Resolution: The addition of new course "Food analytics and Quality Assessment- 25CY5222" as a flexi core course was approved without amendments.

Annexure III: Syllabus of new course: "Food analytics and Quality Assessment- 25CY5222".

Agenda 4: Any other item with the permission of the chair

Discussion: The changes in the course outcome statements and CO-PO mapping are reviewed for all the courses. The chair encouraged ongoing collaboration and expressed appreciation for the committee's contributions.

Resolution: It is resolved to incorporate the modified CO statements and CO-PO mapping in line with the revised POs and PEOs. The meeting was concluded with thanks to all participants.


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DEPARTMENT OF CHEMISTRY

A.Y:2024-2025

KLEF/ CHEM / IQAC - ACADEMICS/ DC Meetings (DAC)/ AQ 8.2

26.03.2025

The DAC meeting was conducted on 26th March 2025 at 10:30 AM in F102.

Agenda:

1. To review and approve the revised vision, mission, POs and PEOs.
2. To review and approve the PAC meeting minutes.
3. To review and approve the VMDRC meeting minutes.
4. Any other item with the permission of the chair.

The meeting started with an address by Dr. A Venkateswara Rao (HOD, Chemistry Department) extending a warm welcome to the department academic Committee members present for the meeting.

The following points were discussed and resolved:

Agenda 1: To review and approve the revised vision, mission, POs and PEOs.

Discussion: The committee examined the revised drafts of the Vision, Mission, Program Outcomes (POs), and Program Educational Objectives (PEOs). Suggestions were made regarding clarity and alignment with institutional goals. All feedback was discussed and addressed appropriately.

Resolution: The revised Vision, Mission, POs, and PEOs were approved. The finalized versions are mentioned under the annexure I and the same are recommended for approval in BOS.

Annexure I: Finalized version of Vision, Mission, POs, and PEOs.

Agenda 2: To review and approve the PAC meeting minutes.

Discussion: The minutes of the previous Program Advisory Committee (PAC) meeting were reviewed. Members confirmed that the minutes accurately reflected the meeting proceedings. No corrections were suggested.

Resolution: The PAC meeting minutes were approved as presented and will be archived accordingly.

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14/3/2025
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Agenda 3: To review and approve the VMDRC meeting minutes.

Discussion: The committee reviewed the minutes of the Vision, Mission Development and Review Committee (VMDRC) meeting. All entries were found to be complete and consistent with the discussions held.

Resolution: The VMDRC meeting minutes were approved without amendments.

Agenda 4: Any other item with the permission of the chair

Discussion: No additional items were proposed. The chair encouraged ongoing collaboration and expressed appreciation for the committee's contributions.

Resolution: No further resolutions were required. The meeting was concluded with thanks to all participants.

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