

B.SC. CHEMISTRY

LOCF SYLLABUS 2026-27



Department of Chemistry

School of Physical Sciences

St. Xavier's College (Autonomous), Palayamkottai

Tirunelveli – 627 002, Tamil Nadu, India

Vision

To mould young men and women as leaders in all walks of life so that they may serve the people especially the poor and the oppressed of our nation, in truth, justice and love.

Mission

To achieve a synthesis of academic excellence and the formation of character.

To ensure social justice through equity and access

To include the excluded for empowerment

To equip students with global competencies

To engage in relevant research activities.

To promote Lab to Land through the Outreach Programme – Student Training and Action for Neighbourhood Development (STAND)

SCHOOLS OF EXCELLENCE WITH CHOICE-BASED CREDIT SYSTEM (CBCS)

Undergraduate Courses

While the Tamil Nadu State Council of Higher Education (TANSCHÉ) came forward to introduce CBCS in all the affiliated colleges in Tamil Nadu in June 2008, St. Xavier's College had already introduced CBCS as early as June 2002 for UG courses and in June 2003 for PG courses. The aim of the Choice-Based Credit System is to provide ample choice of subjects to students, based on the weighted credit point system. This system offers the learners a chance to match their aptitude and interest with the subjects of their choice and learn at their own pace. Thus St. Xavier's College gives every student an opportunity to study his / her discipline - specific courses and pursue other courses from any other department simultaneously.

Essential Features of CBCS

Standardisation of degree courses to internationally accepted levels

Focus on skill-based curriculum

Emphasis on value education

Institution - Industry collaboration

Provision for earning more credits

Development of communication skills

Credit system

The credit system at St. Xavier's College (Autonomous) assigns weightage to courses based on the hours allocated to each course. Typically, one credit is equivalent to one hour of instruction per week. However, credits are awarded regardless of actual teaching hours to ensure consistency and adherence to guidelines. The credits and hours allotted to each course within a programme are detailed in the Programme Pattern table. While the table provides a framework, there may be some flexibility due to practical sessions, field visits, tutorials, and the nature of project work. For undergraduate (UG) courses, students are required to accumulate a minimum of 150 credits, as stipulated in the programme pattern table. The total number of courses offered by the department is outlined in the Programme Structure.

OUTCOME-BASED EDUCATION (OBE)

Outcome-Based Education (OBE) is a student-centric teaching and learning methodology that focuses on measuring student performance through clearly defined outcomes. For St. Xavier's College, with its commitment to excellence and NAAC/NBA accreditation requirements, OBE is not just a regulatory expectation but a pathway to academic quality, global competitiveness, and improved employability of graduates.

We prepare students to meet future industry requirements and reinforce St. Xavier's College, Palayamkottai, as a leader in quality higher education. St. Xavier's College introduced OBE in 2018, and for the Attainment Calculation, we developed our own method in 2018. From the academic year 2025-26 onwards, in examinations, for each question we mark Course Outcome (CO), Competency and Performance Indicator,

Programme Outcome / Programme Specific Outcome, Bloom's Revised Cognitive Level and we follow the OBE procedure for the calculation of the Attainment of Outcome for each student, course, semester, programme.

EVALUATION PATTERN (UG)

Continuous Internal Assessment

There is no internal minimum for any paper. However, Continuous Internal Assessment (CIA) is a mandatory requirement for all students. A student must take at least one CIA test out of two tests and must fulfil at least one mode of assessment among assignments, quiz, seminars, etc., otherwise he/she will not be permitted to write the semester examination.

S.No	Component	Marks Allotted
1	I CIA Test	50
2	II CIA Test	50
	Total	100

The total CIA marks of 100 will be converted to 70 marks. An additional 30 marks will be awarded through other internal assessment components.

The Continuous Internal Assessment (CIA) consists of two component tests, each carrying 15 marks (15 + 15).

The final internal assessment marks will be calculated out of 100 (70 + 30). The obtained marks will be converted to 50 marks.

Semester (External) Examination

- The External Semester Examination will be conducted for **100 marks**.
- The obtained marks will be **converted to 50 marks**.

Question Pattern

UG Semester Examinations Part- I & II & III (3 Hours)

PART	TYPE	Mark Distribution	Total Marks
A	MCQ	20X1	20
B	ALL	5X3	15
C	Either/or	5X7	35
D	3 out of 5	3X10	30
		Total	100

UG Semester Examinations Part- IV (2 Hours)

PART	TYPE	Mark Distribution	Total Marks
A	MCQ	5X1	5
B	ALL	5X2	10
C	Either/or	5X5	25
D	1 out of 2	1X10	10
		Total	50

UG Internal Examinations Part- I & II & III (1.30 Hours)

PART	TYPE	Mark Distribution	Total Marks
A	MCQ	6X1	6
B	ALL	3X3	9
C	Either/or	3X5	15
D	2 out of 3	2X10	20
		Total	50

UG Internal Examinations Part- IV (1.00 Hour)

PART	TYPE	Mark Distribution	Total Marks
A	MCQ	5X1	5
B	ALL	5X3	15
C	2 out of 3	2X7.5	15
		Total	35

Grading System

Range of Marks	Letter Grade	Grade Point	Description
90-100	A+	9.0-10.0	Outstanding
80-89	A	8.0-8.9	Excellent
70-79	B+	7.0-7.9	Very Good
60-69	B	6.0-6.9	Good
50-59	C	5.0-5.9	Above Average
40-49	D	4.0-4.9	Average
00-39	U	0	Reappear

Programme: B.Sc. Chemistry**Programme Code: UCH****PROGRAMME OUTCOMES (PO)**

Students of the undergraduate programme in chemistry, at the time of graduation, will be able to attain the following the following programme outcomes (POs):

PO1. Critical thinking: Acquire the knowledge in the respective field and take informed actions

PO2. Effective communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social interaction: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

PO4. Effective Citizenship: Demonstrate empathic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different values systems and apply ethical principles and commit to professional ethics and responsibilities and norms of different value systems.

PO6. Environment and Sustainability: Demonstrate the issues of environmental contexts and sustainable development.

PO7. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern IT Tools including prediction and modeling to complex activities with an understanding of the limitations.

PO8. Self-directed and lifelong Learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1. Fundamental Chemical Knowledge: Gaining a wide and deep-rooted knowledge on laws, principles, postulates, theories and concepts of various branches of chemistry with their interrelations.

PSO2. Application of Chemical Principles to Reactions and Processes: Utilisation of knowledge of molecular structure, bonding and reaction mechanism to achieve prediction of chemical reactivity, to explain reaction pathways and to solve problems in synthesis with theories behind.

PSO3. Laboratory Expertise with Safety Measures: Performance with accuracy and precision of quantitative and qualitative experiments, leading to designing of new methods and synthesis of novel materials, adhering to the standards of ethics and safety.

PSO4. Problem-Solving Skills in Chemistry: Application of numerical calculations with logical reasoning in solving problems of chemical sciences along with handling of instruments and interpretation of various spectra.

PSO5. Best Practices for Social Sustenance: Promotion of utilisation of green chemical practices for minimisation of byproducts and starting materials using microscale techniques, and hence for addressing sustainable society and cleaner environment.

PSO6. Interdisciplinary approach and Industrial applications: Realisation of usefulness of chemical knowledge in applied fields such as pharmaceuticals, agriculture, food, cosmetics, novel materials, biochemistry, polymers and forensics to face current challenges and to meet future needs.

PSO7. Chemistry for social development: Promotion of innovations in the development of solutions with the help of understanding on structure, functions and properties of chemical substances for problems to ensure social wellness.

PSO8. Technological Proficiency and Career Competence: Develop core scientific skills by applying chemical principles, design chemical reactions, interpret experimental chemistry, build analytical chemistry techniques and problem-solving competencies essential for progression, research involvement, and applications.

B.SC CHEMISTRY COURSE PATTERN
(WITH EFFECT FROM JUNE 2026)

Sem	Part	Status	Sub. Code	Title of the Paper	Hrs	Credits
I	I	Lang	26UGTL11	General Tamil – I	6	3
	I	Lang	26UGHL11	Hindi – I		
	I	Lang	26UGFL11	French - I		
	II	Lang	26UGEL11	General English - I	6	3
	III	Core-T1	26UCHC11	Inorganic Chemistry I	5	5
	III	Core-P1	26UCHC12	Practical: Inorganic Volumetric Estimation-I	3	3
	III	EC-T1	26UMAE11	Allied Mathematics-I	6	5
	IV	SEC1	26UCHN11	Role of Chemistry in daily life (NME)-Practical	2	2
	IV	FC	26UHER11/ 26UHEE11	Foundation Course - Religion: Catholic Doctrine/ Ethics	2	2
					30	23
II	I	Lang	26UGTL21	General Tamil – II	6	3
	I	Lang	26UGHL21	Hindi – II		
	I	Lang	26UGFL21	French – II		
	II	Lang	26UGEL21	General English- II	6	3
	III	Core-T2	26UCHC21	Organic Chemistry - I	5	5
	III	Core-P2	26UCHC22	Practical: Inorganic Volumetric Estimation-II	3	3
	III	EC-T2	26UMAE21	Allied Mathematics - II	6	5
	IV	SEC2	26UCHN21	Food Chemistry (NME)-Practical	2	2
	IV	SEC3	26UHEI21	Integrated personality development	2	2
					30	23
III	I	Lang	26UGTL31	General Tamil – III	6	3
	I	Lang	26UGHL31	Hindi – III		
	I	Lang	26UGFL31	French - III		
	II	Lang	26UGEL31	General English- III	6	3
	III	Core-T3	26UCHC31	Inorganic Chemistry-II	5	5
	III	Core-P3	26UCHC32	Practical: Inorganic Qualitative Analysis - I	3	3
	III	EC-T3	26UPHE31	Allied Physics - I	4	3
	III	EC-P1	26UPHE32	Allied Physics-I (Practical)	2	2
	IV	SEC4	26UHEL31	Life coping and Entrepreneurial skills management	2	2
					2	2
					30	23
IV	I	Lang	26UGTL41	General Tamil – IV	6	3
	I	Lang	26UGHL41	Hindi – IV		
	I	Lang	26UGFL41	French – IV		
	II	Lang	26UGEL41	General English- IV	6	3
	III	Core-T4	26UCHC41	Organic Chemistry - II	4	4
	III	Core-P4	26UCHC42	Practical: Inorganic Qualitative Analysis-II	3	3

	III	EC-T4	26UPHE41	Allied Physics - II	3	3
	III	EC-P2	26UPHE42	Allied Physics – II (Practical)	2	2
	IV	EC-T5	26UCHE43	Thermodynamics and Solid State	4	4
	IV	EVS	26UEVS41	Environmental Studies	2	2
	V	EXTENSION		STAND	-	1
		ACTIVITIES				
					30	25
V	III	Core-T5	26UCHC51	Organic Chemistry - III	4	4
	III	Core-T6	26UCHC52	Inorganic Chemistry - III	4	3
	III	Core-T7	26UCHC53	Physical Chemistry - I	4	3
	III	Core-T8	26UCHC54	Physical Chemistry - II	4	3
	III	EC-T6	26UCHE51	Biomolecules/Medicinal Chemistry	2	2
	III	Core-P5	26UCHC55	Inorganic Gravimetric Estimation and preparation of Coordination compounds	4	3
	III	Core-P6	26UCHC56	Estimation of organic compounds and Preparation of organic compounds	4	3
	III	EC-P3	26UCHEP51	Applied Chemistry Practical	2	1
	IV	VE	26UVEH51	Human Rights and Social Analysis	2	2
	IV	Internship	26UCHI51	Internship	-	2
					30	26
VI	III	Core-T9	26UCHC61	Organic Chemistry - IV	4	4
	III	Core-T10	26UCHC62	Inorganic Chemistry - IV	4	3
	III	Core-T11	26UCHC63	Physical Chemistry - III	4	3
	III	EC-T7	26UCHE61	Selected Topics in Chemistry/ Green Chemistry	2	1
	III	Core-P7	26UCHC64	Physical Chemistry Practical I	4	2
	III	Core-P8	26UCHC65	Qualitative analysis of organic compounds	4	2
	III	EC-P4	26UCHEP61	Physical Chemistry Practical II	2	1
	III	Core	26UCHC66	Project with Viva Voce	4	2
	IV	SEC6	26UCHS61	Computer Applications in Chemistry	2	2
					30	20
					180	140
				Additional Compulsory Courses		
I UG		Add-on	26UCHAO1	Experimental techniques in chemistry		2
II UG		Value Added	26UCHVA1	Food chemistry		2
Sem I – Sem VI	ECC (ANYONE)	26UCHEC1	Analytical Chemistry			2
		26UCHEC2	Leather Chemistry			
		26UCHEC3	Forensic Chemistry			
		26UCHEC4	Pollution control			
		26UCHEC5	Applied Chemistry			
		26UCHEC6	Space Chemistry/			
			Artificial Intelligence in Chemistry			
				Field Visit / Industrial Visit		1
				Compulsory MOOC		2
				Cocurricular / Extra Curricular Activities		1
				Total	180	150

பொதுத்தமிழ் - I
26UGTL11

Sem	Course Code	Course Category	Hours	Credit	MARK FOR EVALUATION		
					CIA	ESE	TOTAL
I	26UGTL11	GT	6 Hrs	3	100	100	100
COURSE TITLE		பொதுத்தமிழ் - I					

COURSE OUTCOMES: (பயன்கள்)

CO1	பாரதியார் காலந்தொட்டுத்தற்காலப் புதுக்கவிதைகள் வரையிலானகவிதைகளை அறிமுகப்படுத்துவதால் படைப்பாற்றல் திறன் பெறுதல் (K1, K2)
CO2	புதுக்கவிதைவரலாற்றினைஅறிந்துகொள்ளுதல்.(K2)
CO3	இக்கால இலக்கியவகையினைக் கற்பதன் மூலம் படைப்பாக்கத்திறனைப்பெறுதல்.(K4)
CO4	மொழிஅறிவோடுசிந்தனைத் திறன் அதிகரிக்கச் செய்தல்.(K3)
CO5	தமிழ்மொழியைப் பிழையின்றிஎழுதவும்,புதியகலைச்சொற்களைஉருவாக்கவும் அறிந்து கொள்ளுதல்.(K4)
CO6	காலந்தோறும் சமூகச் சிந்தனைகள் மாறுவதை இலக்கியவரலாற்றின் மூலம் புரிந்துகொள்ளுதல்.(K6)

UNITS	SYLLABUS CONTENTS	HOURS
I	மரபுக் கவிதை 1. பெ.சுந்தரனார் - தமிழ்த்தெய்வவணக்கம் 2. இராமலிங்கஅடிகளார் - வள்ளலார் பாடல்கள் 3. பாரதியார் - பாரத ஜனங்களின் தற்கால நிலைமை 4. பாரதிதாசன் - சிறுத்தையே வெளியில் வா 5. மு.நல்லசுவாமிபண்டிதர் - சிலுவைத் தியானமாலை - மரியாள் புலம்பல் 6. கவிமணிதேசிகவிநாயகம்பிள்ளை -புத்தரும் ஏழைச்சிறுவனும் 7. முடியரசன் - மொழிஉணர்ச்சி 8. கண்ணதாசன் - ஆட்டனத்திஆதிமந்தி – ஆதிமந்திபுலம்பல் 9. கல்யாணசுந்தரம் - பட்டுக்கோட்டையார் பாடல் புதுக்கவிதை 1. கவிக்கோஅப்துல் ரகுமான் - வீட்டுக்கொருமரம் வளர்ப்போம் 2. சிற்பி- கவிதைமுடியவில்லை 3. மு.மேத்தா- வாழைமரத்தின் சபதம் 4. வைரமுத்து- புத்தகப்புராணம் 5. ஞானக்கூத்தன் - அம்மாவின் பொய்கள் 6. அறிவுமதி-வள்ளுவம் பத்து 7. நா.முத்துக்குமார் - ஆனந்தயாழை மீட்டுகிறாய் 8. சுகிர்தாராணி- சபிக்கப்பட்டமுத்தம் 9. அபிமானி - தலித்தியக்கவிதைகள் - 10. வைகைச் செல்வி – அம்மி 11. நாட்டுப்புறப்பாடல்	30

II	சிறுகதைகள் 1. புதுமைப்பித்தன் - கடவுளும் கந்தசாமிப் பிள்ளையும் 2. கு.ப.ராஜ கோபாலன் - விடியுமா? 3. கி.ராஜநாராயணன் - கதவு 4. வண்ணதாசன் - ஒருசிறுஇசை 5. உமாமகேஷ்வரி - மரப்பாச்சி உரைநடை 1. இலக்கியத்தின் உயிர்- இரா.மோகன் 2. இருபதாம் நூற்றாண்டுக்கவிதைகளில் தொழிலாளர் நிலை- இரா.மோகன் 3. எண்பதுகளில் புதுக்கவிதைப் போக்குகள் - இரா.மோகன் 4. தமிழ்ச் சிறுகதைகளில் முன்னிலைஉத்தி- இரா.மோகன் 5. வளமுடன் வாழ - அருள்முனைவர் ச.இன்னாசிமுத்து.சே.ச.	15
III	தமிழ் இலக்கியவரலாறு (இக்கால இலக்கியம்)	15
IV	இலக்கணம் - எழுத்து 1. தொல்காப்பியத்தின் எழுத்துவகை 2. முதல் எழுத்துக்கள் 3. சார்பெழுத்துக்கள் 4. மொழிமுதல் எழுத்துக்கள் 5. மொழி இறுதிஎழுத்துக்கள் 6. மொழி இடைஎழுத்துக்கள் 7. போலி 8. பதவிலக்கணம் 9. புணர்ச்சி இலக்கணம்	15
V	பிழையின்றிஎழுதுவோம் 1. பிழைப்பட எழுதும் சொற்களும், திருத்தங்களும் 2. சொற்பொருள் வேறுபாடு 3. பிழையான வாக்கியங்களும், திருத்தங்களும் 4. நிறுத்தற்குறிகள் 5. மரபு 6. வல்லெழுத்து (க்.ச்.த்,ப்) மிகுமிடங்கள் 7. வல்லெழுத்துமிகா இடங்கள் 8. வாக்கியம் :வகைகளும்,மாற்றங்களும் 9. வழ(ழு)க்குத் தமிழ் 10.உவமைகள் - பழமொழிகள் - மரபுத் தொடர்கள்	15
TEXT BOOKS (பாடநூல்கள்)		
- தமிழ்த்துறை வெளியீடு- தூய சவேரியார் கல்லூரி,(தன்னாட்சி)பாளையங்கோட்டை. - வகைமைநோக்கில் தமிழ் இலக்கியவரலாறு- பாக்கியமேரி		
REFERENCE BOOKS (பார்வைநூல்கள்)		
- தமிழ் இலக்கியவரலாறு- சிறிபிபாலசுப்பிரமணியன் - புதியநோக்கில் தமிழ் இலக்கியவரலாறு- தமிழண்ணல் - தமிழ் இலக்கியவரலாறு- சேதுராமன்		
WEB SOURCES(இணையதளங்கள்)		
- Tamil Heritage Foundation – www.tamilheritage.org - Tamil Virtual University Library – www.tamilvu.org/library - Project Madurai – www.projectmadurai.org - Chennai Library – www.chennaiLibrary.com - Tamil University Library – www.ulib.prg - Tamil E-books downloads – tamilebooksdownloads.blogspot.com - Tamil Books online – books.tamilcube.com - Catalogue of the Tamil Books in the library of British congress archive.org		

பொதுத்தமிழ் - II
26UGTL21

Sem	Course Code	Course Category	Hours	Credit	MARK FOR EVALUATION		
					CIA	ESE	TOTAL
II	26UGTL21	GT	6 Hrs	3	100	100	100
COURSE TITLE		பொதுத்தமிழ் - II					

COURSE OUTCOMES (பயன்கள்)

CO1	பக்தி இலக்கியத்தின்தோற்றம்,வளர்ச்சி சிற்றிலக்கியத்தின் தோற்றம்,வளர்ச்சி குறித்து அறிந்துகொள்வர்.(K1)
CO2	பக்தி இலக்கியங்கள் ,சிற்றிலக்கியங்கள் முதலியவற்றின் இலக்கண மற்றும் இலக்கிய அமைப்பை விளங்கிக் கொள்வர் (K2)
CO3	பக்தி இலக்கியப் பாடல்களில் காணப்படும் தெய்வவழி பாட்டுணர்வு, சிற்றிலக்கியங்களில் காணலாகும் சமூகநீதிக் கருத்துகளை, இன்றைய வாழ்வோடு தொடர்புபடுத்தி நோக்குவர் (K3)
CO4	பக்தி இலக்கியம் சிற்றிலக்கியங்களின் வழி இலக்கண இலக்கியச்சிறப்புகளை ஒப்பிட்டுப் பேதங்களைக் காண்பர். (K3)
CO5	பக்தி இலக்கிய, சிற்றிலக்கியங்களின் வழி தமிழ்மொழி, பண்பாடு, மதம், தத்துவம் ஆகியவற்றினை மதிப்பிட்டுச் சீர்தூக்கிப் பார்ப்பர் (K5)
CO6	கற்ற இலக்கியங்களை அடிப்படையாகக் கொண்டு,சிறுபக்திக் கவிதைகள் அல்லது சிற்றிலக்கிய மரபில் பாடல் இயற்றும் திறன் பெறுவர்.,(K6)

UNITS	SYLLABUS CONTENTS	HOURS
I	பக்தி இலக்கியம் -1 1. திருஞானசம்பந்தர் - திருக்கோடிக்கா 2. திருநாவுக்கரசர் - திருப்பாதிரிப்புலியூர் 3. திருப்பாவை - ஆண்டாள் 4. குலசேகரஆழ்வார் - 5 ஆம் பதிகம் 5. சித்தர் பாடல்கள் - அழகணிசித்தர் (தேர்ந்தெடுக்கப்பட்டபாடல்கள்) சிற்றிலக்கியம்: 2 1 கலிங்கத்துப்பரணி - களம் பாடியது 2. திருக்குற்றாலக் குறவஞ்சி - மலைவளம் 3. திருக்காவலூர்க்கலம்பகம் - சமூகஉல்லாசம் 4. முக்கூடற்பள்ளு-நாட்டு வளம் 5. தமிழ்விடுதாது - தூதுக்கானகாரணம்	30
II	ஊரைநடை 1. இறைநம்பிக்கையும் மனிதவாழ்வும் 2. இயேசுபிரான் குறிப்பிடும் எண்வகைமனிதர்கள் 3. நபிகள் நாயகத்தின் வாழ்வியல் நெறிகள் 4. திருமூலர் காட்டும் இறைநெறி 5. வள்ளலார் கூறும் வாழ்வியல் நாவல் - கருப்பாயி என்கிற நூர்ஜஹான் -அன்வர் பாலசிங்கம்	15
III	தமிழ் இலக்கியவரலாறு (பக்திஇலக்கியம்,சிற்றிலக்கியம் தொடர்பானபகுதிகள்)	15
IV	இலக்கணம் சொல்லின் இலக்கணம்-பெயர் ,வினை, இடை,உரிச்சொற்கள்	15

	பிறமொழிச் சொற்களைத் தமிழில் வழங்கும் முறை	
V	மொழிபெயர்ப்பு ஆட்சிச் சொல்லகராதி - மரபுத் தொடர்கள் -பழமொழிகள் - திருக்குறள்	15
TEXT BOOKS (பாடநூல்கள்)		
1. தமிழ்த்துறைவெளியீடு - தூயசவேரியார் தன்னாட்சிக் கல்லூரி,பாளையங்கோட்டை. 2. வகைமைநோக்கில் தமிழ் இலக்கியவரலாறு - முனைவர்பாக்கியமேரி 3. கருப்பாயின்கிறநூர்ஜஹான் -அன்வர் பாலசிங்கம்		
REFERENCE BOOKS (பார்வைநூல்கள்)		
• தமிழ் இலக்கியவரலாறு - சிற்பி. பாலசுப்பிரமணியன் • புதியநோக்கில் தமிழ் இலக்கியவரலாறு - தமிழண்ணல் • தமிழ் இலக்கியவரலாறு- சேதுராமன்		
WEB SOURCES (இணையதளங்கள்)		
• Tamil Heritage Foundation- www.tamilheritage.org • Tamil virtual University Library- www.tamilvu.org/ library http://www.virtualvu.org/library • Project Madurai - www.projectmadurai.org. • Chennai Library- www.chennailibrary.com . • Tamil Universal Digital Library- www.ulib.prg . • Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com		

பொதுத்தமிழ் - III
26UGTL31

Sem	Course Code	Course Category	Hours	Credit	MARK FOR EVALUATION		
					CIA	ESE	TOTAL
III	26UGTL31	GT	6 Hrs	3	100	100	100
COURSE TITLE		பொதுத்தமிழ் - III					

COURSE OUTCOMES (பயன்கள்)

CO1	மாணவர்கள் காப்பியம், உரைநடை, ஊடகத்தமிழ், இலக்கணம், யாப்பு ஆகியவற்றின் அடிப்படைக் கருத்துக்கள்,பண்புகள், வரலாற்றுப் பின்னணிகளை அறிதல். (K1)
CO2	மாணவர்கள் தமிழ் இலக்கியவடிவங்கள் (காப்பியம்,உரைநடை) மற்றும் இலக்கணக் கூறுகளைப் (எழுத்து,சொல்,பொருள்,யாப்பு) புரிந்துகொண்டு அவற்றின் தனித்துவங்களைவிளங்கிக் கொள்ளல். (K2)
CO3	மாணவர்கள் கற்ற இலக்கணவிதிகள் மற்றும் யாப்புமுறைகளைப் பயன்படுத்தி சரியான தமிழ் வாக்கியங்களையும் செய்யுள்களையும் உருவாக்கப் பயிற்சியளித்தல். (K3)
CO4	மாணவர்கள் காப்பியங்கள் மற்றும் உரைநடைப் படைப்புகளைப் பகுத்து, ஆய்வுசெய்து,அதன் கருத்து,கட்டமைப்பு, இலக்கியநயம் ஆகியவற்றை ஆராய்தல். (K4)
CO5	மாணவர்கள் இலக்கியப் படைப்புகளைதரம்,மொழிநடை, இலக்கணஅமைப்பு ஆகியவற்றைவிமர்சனமுறையில் மதிப்பீடுதல், (K5)
CO6	மாணவர்கள் தமிழ் இலக்கணம் மற்றும் யாப்புஅடிப்படையில் சுயமாக செய்யுள்,கட்டுரை,உரைநடைப் படைப்புகளைஉருவாக்கப் பயிற்சியளித்தல்;(K6)

UNITS	SYLLABUS CONTENTS	HOURS
I	1. சிலப்பதிகாரம் - வழக்குரைக் காதை. 2. மணிமேகலை- ஆபுத்திரன் திறம் அறிவித்தகாதை. 3. சீவகசிந்தாமணி- பதுமையர் இலம்பகம். 4. கம்பராமாயணம் - மந்தரைச் சூழ்ச்சிப் படலம்.	30
	1. சூளாமணி 2. உதயணகுமாரகாவியம் 3. இயேசுகாவியம் 4. மருமக்கள் வழி மான்மியம்	
II	ஊரைநடை 1. காளத்திவேடனும் கங்கைவேடனும். 2. தீமையை இயற்றும் தன்மையினர் கூனி இயாகோ. 3. சிலம்புகாட்டும் சீர்மிகு சிந்தனைகள். 4. மணிமேகலை காப்பியத்தில் மானுட விழுமியங்கள். நாடகம் - வேலைக்காரி - அறிஞர் அண்ணா.	15
III	தமிழ் இலக்கிய வரலாறு (காப்பியங்கள்)	15
IV	இலக்கணம் - யாப்பு,எழுத்து, அசை. சீர்,தளை, அடி,தொடை,பா வகைகள்	15
V	ஊடகத்தமிழ் - விளக்கம், வகைகள்,செயல்பாடுகள் 1.இதழ்கள்	15

	2.வானொலி 3.தொலைக்காட்சி 4.திரைப்படம்	
TEXT BOOKS (பாடநூல்கள்)		
- தமிழ்த்துறைவெளியீடு-தூயசவேரியார்க் கல்லூரி,(தன்னாட்சி) பாளையங்கோட்டை. - வகைமைநோக்கில் தமிழ் இலக்கியவரலாறு-பாக்கியமேரி		
REFERENCE BOOKS (பார்வைநூல்கள்)		
- தமிழ் இலக்கியவரலாறு-சிற்பிபாலசுப்பிரமணியன் - புதியநோக்கில் தமிழ் இலக்கியவரலாறு-தமிழண்ணல் - தமிழ் இலக்கியவரலாறு-சேதுராமன்		
WEB SOURCES (இணையதளங்கள்)		
- Tamil Heritage Foundation – www.tamilheritage.org<http://www.tamilheritage.org> - Tamil Virtual University Library – www.tamilvu.org/library http://www.virtualvu.org/library - Project Madurai – www.projectmadurai.org - Chennai Library – www.chennailibrary.com<http://www.chennailibrary.com - Tamil University Library – www.ulib.prg<http://www.ulib.prg> - Tamil E-books downloads – tamilbooksdownloads.blogspot.com - Tamil Books online – books.tamilcube.com - Catalogue of the Tamil Books in the library of British congress archive.org		

பொதுத்தமிழ் - IV
26UGTL41

Sem	Course Code	Course Category	Hours	Credit	MARK FOR EVALUATION		
					CIA	ESE	TOTAL
IV	26UGTL41	GT-IV	6 Hrs	3	100	100	100
COURSE TITLE		பொதுத்தமிழ்- IV					
COURSE OUTCOMES (பயன்கள்)							
CO1:	பழந்தமிழ் இலக்கியவரலாற்றறிவைப் பெறுதல் (K1, K2)						
CO2:	சங்க இலக்கிய அறிமுகங்களின் ஊடாகத் தமிழர் வாழ்வியல் நெறிகளை உணர்தல். (K2,K3)						
CO3:	தமிழ் இலக்கியங்களின் செய்யுள் உருவம்,உள்ளடக்கம், படைப்பியல் கொள்கைகளைப் புரிந்துகொள்ளுதல். (K4)						
CO4:	அகத்திணை,புறத்திணைவாழ்வியல் நெறிப்பாடுகளின் ஊடாகத் தமிழர்ப்பண்பாட்டு அடிப்படைகளை மதிப்பிடும் திறன் பெறுதல். (K2,K3)						
CO5:	மொழித்திறன்,படைப்புத்திறன் பெறுதல். (K3,K4)						
CO6:	நாடக இலக்கியஅனுபவத்தின் வழியாகதமிழ்ச் சமூகநிலைகளை இலக்கியமாக்கும் நுட்பங்களைப் பெறுதல். (K2,K6)						

UNITS	SYLLABUS CONTENTS	HOURS
I	செய்யுள் பகுதி 1 1. நற்றிணை (5பாடல்கள்) 2. குறுந்தொகை (5பாடல்கள்) 3. அகநானூறு (2பாடல்கள்) 4. புறநானூறு (5பாடல்கள்)	30
	செய்யுள் பகுதி 2 1. நெடுநல்வாடை முழுமையும் 2. திருக்குறள் (விருந்தோம்பல், நட்பாராய்தல், குறிப்பறிதல்) 3. நாலடியார் (கல்வி)	
II	உரைநடைக் கட்டுரைகள் 1. ஊரும் பேரும் - ரா.பி. சேதுபிள்ளை 2. தமிழர் பண்பாடும்அதன் சிறப்பியல்புகளும் - தனிநாயகம் அடிகளார் 3. இலக்கியஉருவாக்கமும் பயனும் - சேதுமணிமணியன் பயண இலக்கியம் 1. மண் புதிது - சுப்ரபாரதிமணியன்	15
III	தமிழ் இலக்கியவரலாறு 1. சங்ககாலம் 2. சங்கம் மருவியகாலம்	15
IV	இலக்கணம் -பொருள் 1. அகப்பொருள் 2. புறப்பொருள் 3. அணியிலக்கணம் (உவமை,உருவகம்,பிறிதுமொழிதல்,வஞ்சப்புகழ்ச்சி,தற்குறிப்பேற்ற அணி)	15
V	மொழிப்பயிற்சி 1. ஒப்பும் மறுப்பும் (ஒருகருத்தினை வெட்டி,ஒட்டி எழுதும் பயிற்சி) 2. விண்ணப்பம் எழுதுதல் (பயிற்சி) 3. தமிழில் தன்விவரக் குறிப்புவரைதல் (பயிற்சி) 4. மேடைப்பேச்சு நுட்பங்கள் (நேர்முகப் பயிற்சிமற்றும் மதிப்பீடு)	15

TEXT BOOKS (பாடநூல்கள்)	
1. பொதுத்தமிழ் பாடநூல், தமிழ்த்துறை வெளியீடு ,தூய சவேரியார் கல்லூரி,பாளையங்கோட்டை.	
2. பாக்கியமேரி,தமிழ் இலக்கியவரலாறு,பதினொன்றாம் பதிப்பு - 2025 ,பூவேந்தன் பதிப்பகம்,மயிலாப்பூர்,சென்னை.	
3. சுப்பரத்திமணியன்இமண் புதிது,முதல் பதிப்பு 2018 அறிவுப்பதிப்பகம்,சென்னை.	
REFERENCE BOOKS (பார்வைநூல்கள்)	
பார்வை நூல்கள்	
1. மது.ச.விமலானந்தம்தமிழ் இலக்கியவரலாறு,	
2. மு. வரதராசனார்,தமிழ் இலக்கியவரலாறு,	
3. தமிழண்ணல்,புதியநோக்கில் தமிழ் இலக்கியவரலாறு.	
WEB SOURCES (இணையதளங்கள்)	
• Tamil Heritage Foundation – www.tamilheritage.org<http://www.tamilheritage.org> • Tamil Virtual University Library – www.tamilvu.org/library http://www.virtualvu.org/library • Project Madurai – www.projectmadurai.org • Chennai Library – www.chennailibrary.com<http://www.chennailibrary.com> • Tamil University Library – www.ulib.prg<http://www.ulib.prg> • Tamil E-books downloads – tamilebooksdownloads.blogspot.com • Tamil Books online – books.tamilcube.com • Catalogue of the Tamil Books in the library of British congress archive.org	

HINDI
SEMESTER 1

UNIT I: GRAMMAR

- Swar(स्वर),
- Vyanjan(व्यंजन),
- Barah Khadi(बारहखड़ी),
- Shabd aur Vakya Rachna (शब्द और वाक्य रचना)

UNIT II: SUBODH HINDI RACHNA

- Binna binna arth(भिन्न भिन्न अर्थ),
- Numbers (गिनती1-100),
- Vaakyong mein Prayag kijiye (वाक्यों में प्रयोग कीजिये)
- Rishto ke Naam (रिश्तो के नाम)
- Gharelu padartho ke Naam (घरेलू पदार्थों के नाम)

UNIT III: PROSE

- Sadharan Vakya aur Sangya (संज्ञा),
- Sarvanaam(सर्वनाम)
- Visheshan(विशेषण)
- Kriya (क्रिया)

UNIT IV: SHORT STORIES

- Bacho ki Kahaniya

UNIT V: COMPREHENSION

- Sant Tiruvalluvar, संत तिरुवल्लुवर,
- Hamara desh, (हमारा देश,)
- Paryavaran Sanrakshan, (पर्यावरण संरक्षण)
- Naari Sashaktikaran, (नारी सशक्तिकरण)
- Rastriya janvar(राष्ट्रीय जानवर)

Reference Books

Hindi sentences - Chaturbhuj Sahay

Subodh Hindi Grammar - Phoolchand Jain

Sankshipt Hindi Grammar - Kamta Prasad

Practical Hindi - Nagappa

Abhinav Hindi Grammar – Nagappa

Saral Hindi Grammar - Shyamchandra Kapur

Grammar Pradeep - Ramdev

Laghu Bal Kathaye - Ramashankar

Captivating Stories - Premchand

CONCISE GRAMMAR OF THE HINDI LANGUAGE - H.C Scholberg

Hindi Grammar - Edwin Greaves

SEMESTER II

UNIT I: Hindi Ekankiya

- Sooryodhaya(सूर्योदय),
- Mayoppiya (मायोपिया),
- Udhayan (उदयन),
- Upendranath Ashk – Lakshmi ka Swagat

Characters: (Tippani)

- Nirjarani (निर्झरणी),
- Sudhi(सुधी)
- Thathagath(तथागत),
- Udhayan (उदयन),

UNIT II: Hindi Kahaniya

- Premchand – Bade Ghar ki Beti
- Malathi Joshi – Vo Tera Ghar Yah Mera Ghar
- Gyanranjan - Pita

UNIT III: ANCIENT POETRY

- Pathya Chayanika– KabeerDhoha–Saaki (साखी) 1 to 10.

UNIT IV: Vyakaran

- Kriya Visheshan (क्रियाविशेषण),
- Sambandh Bodhak (संबंधबोधक),
- Samuchay Bodhak (समुच्चयबोधक)
- Vismayadi Bodhak (विस्मयादिबोधक) aadi shabdo ka prayog

UNIT V:

Pratiyogi Pariksha par aadharit Nimnalikhit Vishayo se sambandhit Prashikshan Karya

- Tamil Bhasha: Mahakavi Bharatiyar
- Sanket Vikas dwara Lekhan kala aur Kahani Lekhan ka Vikas
- Gadyansh dekhkar sahi Shirshak chunna
- Pathit Vyakaran par aadharit Vakya rachna
- Vibhinna Pratiyogi parikshao ke bare mein suchna pradan dena

Reference Books

- Sooryodaya (Dakshin Bharat Hindi Pracharsabha publications)
- Aath Ekanki Natak - Ed. Dr. Ramkumar Verma
- Das Ekanki

SEMESTER III

Niji Patra – Arth aur Bhed, Pitaji/Mataji ke naam patra, Mitra, Bhai aadi ke naam patra

UNIT I: Niji Patra Lekhan

- Niji Patra - Arth aur Bhed
- Pitaji/Mataji ke naam patra
- Mitra, Bhai aadi ke naam patra
- Paribhashik Shabdawali - 20 words

Unit II

- Samajik Patra Lekhan
- Aavedan Patra - Noukri, Chutti aadi
- Dak Adhikari ke naam patra
- Paribhashik shabdawali - 20 words

Unit III

- Vyavasayik Patra Lekhan
- Vyavasayik Patra - Arth aur Bhed
- Prakashak ke naam patra
- Shikayathi
- Paribhashik shabdawali - 20 words

Unit IV

- Samanya Parichay
- Sarkari Patra
- Ardh-Sarkari Patra
- Gyapan, Paripatra
- Anusmarak
- Paribhashik Shabdawali - 20 words

Unit V

- Precis Writing And Applied Grammar (Ling, Vachan and Karak)
- Karak (कारक)
- Vachan badaliye(वचन बदलिए),
- Ling badaliye(लिंग बदलिए)

Reference Books

- Viyavaharik Hindi, Hindi Prachar press, T.Nagar, Madras-600 017
- Alekhan aur Tippan - Prof. Viraj
- Alekhan Kichlu

SEMESTER IV

UNIT I: STORIES (दक्षिणी कथाएं)

- Meri pathni(मेरी पत्नी),
- Thotha aur Mynah(तोता और मैना),
- Noorunisha(नूरनिशा),
- Mruthudhand (मृत्यु दंड),
- Karmaveer(कर्मवीर) and their Characters.

UNIT II: Proud yogiki aur Hindi

- Unicode
- Dewanagari Lipi
- Hindi ki Vibhinna Website - Ek Parichay

UNIT III: POETRY (काव्यशास्त्र)

Ras :

- Kavyaras (काव्यरस),
- Veer ras (वीररस),

Sandh:

- Chowpayi (चौपाई),
- Rola(रोला),

Alankar:

- Yamakalankar (यमकअलंकार),
- Upmaalankar (उपमाअलंकार).

UNIT IV:

AUTOBIOGRAPHY (Sathya ka Swar–Gandhiji ki Jeevani)

- Ma, bap aur Janma(मां, बाप और जन्म)
- Ladakpan (लड़कपन)
- High school mein (हाई स्कूल में)
- Vivah aur Mamsabhakshan(विवाह और मांस भक्षण)
- Ankhen Kuli (आंखें खुली)

Unit V :Pratiyogi priksa par aadharit Computer sambandhit prashikshan Karya

- Hindi mein Powerpoint banana
- Hindi mein Google Document taiyar karna
- Hindi mein Google form taiyar karna
- Vibhinna pratiyogi pariksha ke bare mein suchna pradan karna

Reference Books

- Social Networking: Naye Samay ka Samvad – Ed. Sanjay Dwivedi
- Jansanchar aur Maas Culture - Jagdeeshwar
- Media: Bhumandalikaran aur Samaj - Ed. Sanjay Dwivedi
- Naye Jamane ki Patrakarita - Sourabh Shukla
- Patrakarita se Media tak - Manoj Kumar

French semester-I

UNIT. I

Communication:	Decrire la salle de classe et le professeur.
Grammaire :	Les articles indefinis et defines, les verbes reguliers et irreguliers.
Culture:	Les symbols de la France.
Projet:	Desiner les objets dans le sac et dans la trousse.

UNIT. II

Communication:	Parler de la journee.
Grammaire :	Les verbes pronominux,Affirmatif Negatif et interrogatif
Culture:	Les Frontieres de la France.
Projet:	Faire un rapport sur la journee des parents.

UNIT. III

Communication:	se presenter, parler de la nationlite, dire son numero de telephone.
Grammaire :	Les prepositions , Accord adjective nom, verbes aller venir.
Culture:	Les fete en France trditions et multi culturralisme.
Projet:	faire une liste des camarades et noter leurs numeros de telephone a haute voix et demander a un ami de verifier.

UNIT. IV

Communication:	parler de la nourriture et des repas simples et sains.Decrire les repas.
Grammaire :	L'impertif, Les articles partitifs,
Culture:	Les plats francais.
Projet:	Dessiner et decrire l nourriture que les gens mangent dans leur pays,

UNIT. V

Communication:	Exprimer ses gouts.
Grammaire :	Les adjectifs qulificatifs, les adjectifs possessifs, La negation.
Culture:	La France et ses regions.
Projet:	qu'est-ce que tu aimes faire pendant ton temps libre?

- Lecon 1.** La vie scolaire de luc
- Lecon 2.** La vie quotidienne de luc
- Lecon 3.** Le monde multiculturel
- Lecon 4.** La bonne nourriture
- Lecon 5.** Parlons de nos preferences

Ref.Avenir method de francais 3

French
Semester-II

UNIT. I

Communication:	Demander et donner les directions , Situer un endroit (sur la carte)
Grammaire :	Les prepositions L'interrogation.
Culture:	Les vêtements français.
Projet:	Faire une carte de la ville imaginaire.

UNIT. II

Communication:	Parler de la semaine ,Parler des activités faites pendant la semaine.
Grammaire :	Les articles contractes,Les adjectifs démonstratifs, les expressions avec les verbes Faire et Avoir.
Culture:	Les villes connues en France.
Projet:	Preparer un emploi du temps avec des activités faites pendant la semaine.

UNIT. III

Communication:	Parler du passé, Raconter le week end dernier.
Grammaire :	Le passé composé avec l'auxiliaire avoir, La formation du participe passé.
Culture:	Noël
Projet:	Faire un petit dossier sur les activités faites pendant les vacances d'été.coller les photos de ces activités faites.

UNIT. IV

Communication:	Parler du passé, Raconter les vacances dernières
Grammaire :	Le passé composé avec l'auxiliaire être.
Culture:	Les montagnes en France.
Projet:	Preparer un dossier sur la fête favorite célébrée l'année dernière.

UNIT. V

Communication:	Parler de la ville de demain , Exprimer des projets et des prédictions.
Grammaire :	Le futur proche, Le futur simple.
Culture:	Les monuments en France.
Projet:	Imaginer et présenter la ville du futur

Leçon 6. Sara cherche son chemin

Leçon 7. Ma semaine en action

Leçon 8. Mon weekend dernier

Leçon 9. Mon séjour à Annecy

Leçon 10. La ville du futur

Ref.Avenir method de français 3

French
semester-III

UNIT. I

- Communication:** Decrier ce que les Francais aiment faire , Parler de la vie des Francais.
- Grammaire :** Les articles indefinis et defins ,Les articles partitifs,Les articles contractes.
- Culture:** La France dans le Coeur des Francais.
- Projet:** Preparer un dossier sur ce que les gens du pays aiment faire.

UNIT. II

- Communication:** Comparer la vie des adolescents d'autrefois et d'aujourd'hui.
- Grammaire :** Le negation,Les articles.
- Culture:** Les sous cultures adolescents.
- Projet:** Decrivez la vie des adolescents d'hier et d'aujourd'hui.

UNIT. III

- Communication:** Parler d'un sport.
- Grammaire :** L'imperatif,L'interrogation questions/reponses,Lesconjonctins.
- Culture:** Le sport en France.
- Projet:** Parler du sport favort.

UNIT. IV

- Communication:** Decriver les vacances,Racontredes experiences,Envoyerles mails.
- Grammaire :** Le passe compose.
- Culture:** La France ,une destination touristique.
- Projet:** Dessiner ou coller les images de l'anniversaire fete l'annee derniere, rediger un petit texte pour raconter ce jour.

UNIT. V

- Communication:** Parler d'une sortie scolaire,Ecrire un e-mail.
- Grammaire :** Le passe recent, le futur proche .
- Culture:** Les penitures celebres du muse du Louvre.
- Projet:** Ecris sur une visite au muse.

- Lecon 1.** Esprit Francais.
- Lecon 2.** Les ados modernes
- Lecon 3.** Une grande aventure a velo
- Lecon 4.** Un sejour a nice
- Lecon 5.** La sortie au muse scientifique

Ref.Avenir method de francais 4

French
Semester-IV

UNIT. I

Communication:	Parler de l'automobile
Grammaire :	Les adjectifs les verbes .
Culture:	Les automobiles en France.
Projet:	Faire un dossier sur ta voiture .Coller une photo de cette voiture et decire cette voiture.

UNIT. II

Communication	Reflechir aux villes a venir,Parler des projets d'avenir.
Grammaire :	Le futur simple ,le futur proche.
Culture:	Les projets d'avenir en France
Projet:	preparer un dossier sur les changements attendus dans la ville

UNIT. III

Communication:	partager la recette , Parler de la nourriture.
Grammaire :	Les adverbs de quantite,l'adjectif indefini.
Cultur	les fetes et les traditions.
Projet:	Preparerun dossier sur un dessert prefereet parle de son origine.

UNIT. IV

Communication:	Discuter les avantages d'internet,Ecrire un blog.
Grammaire :	Les adjectifs demonstratifs , Les adjectifs possessifs ,Les prepositions.
Culture:	Les principaux medias francais.
Projet:	Faire un rapport sur les avantages et les inconvenients d'internet.

UNIT. V

Communication:	Rediger des invitations , Ecrire des .messages les consignes, Repondre a une invitation.
Grammaire :	Les verbes pronominaux , les verbes pronominaux a l'impertif.
Culture:	Les arts du spectacle en France.
Projet:	Rediger une belle invitation pour feter l'anniversaire d'un grand parent.

Lecon 6. Le monde des automobiles

Lecon 7. La vie en 2050

Lecon 8. L'epiphanie en France

Lecon 9. La vie en ligne

Lecon 10. On fait quoi ce week-end?

Ref.Avenir method de francais 4

GENERAL ENGLISH

DEPARTMENT OF ENGLISH

UG – PART II - GENERAL ENGLISH

(The Seven-Tier Pattern recommended by UGC Curriculum Development Centre and Identified as Best Practice by NAAC)

	Stream A (For learners of high entry level proficiency)	Stream B (For learners of average entry level proficiency)	Stream C (For learners of low entry level proficiency)
Courses in Semester I	IV 26UGEL14	III 26UGEL13	I 26UGEL11
Courses in Semester II	V 26UGEL25	IV 26UGEL24	II 26UGEL22
Courses in Semester III	VI 26UGEL36	V 26UGEL35	III 26UGEL33
Courses in Semester IV	VII 26UGEL47	VI 26UGEL46	IV 26UGEL44

GENERAL COURSE OUTCOMES

CO1 Acquire the four language skills (Listening, Speaking, Reading, and Writing)

CO2 Develop the skill of independent reading and interpreting of graded texts

CO3 Expand and consolidate active and passive vocabulary

CO4 Acquire the skills needed to participate in a conversation that builds knowledge collaboratively

CO5 Acquire a clear understanding of English Grammar to facilitate the accuracy of communication.

CO6 Develop the skills of formal written communication to be used in academic and career-related contexts

TEXTS

Course I – *SPARK I: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.

Course II - *SPARK II: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.

Course III - *SPARK III: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.

Course IV - *SPARK IV: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.

Course V - *SPARK V: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.

Course VI – *SPARK VI: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.

Course VII - *SPARK VII: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.

EXTERNAL EXAMINATION

❖ External Examination has two components:

1) Written Examination and 2) Spoken English Viva Voce

❖ A three-hour written examination will be conducted for 100 marks for all General English papers and the scores will be converted to 40 marks, with a pass minimum of 16 marks.

❖ At the end of every semester, Spoken English Viva Voce will be conducted for all the students for 100 marks (four components) and the scores will be converted to 10 marks, with a required pass minimum of 4 marks.

❖ To pass in any General English paper, a student must secure the pass minimum of 40 out of 100 (16/40 in Written Examination and 4/10 in Spoken English Viva Voce Examination).

Distribution of marks: **Written Exam** (100 marks) Converted to 40 marks
 Spoken English Viva voce (100 marks) Converted to 10 marks
 TOTAL (40+10) = 50 marks

INTERNAL ASSESSMENT

❖ Two Internal Examinations shall be conducted for 50 marks each along with the Continuous Internal Assessments for 30 marks.

❖ The internal assessment for the courses may include skill-based activities such as seminar presentation/spoken English /critical podcast/ video essay/ creating a 5–8 slides on a topic/ composing a poem/ submitting a relevant photo with description etc.

In both the Internal Examinations and Semester Written Examination, 40% of the mark is allotted for literature-based questions, and 60% of the mark is allotted for grammar and composition exercises.

General English Evaluation Procedure

Internal Examination			Converted to	Total
CIA 1 (Written)	50	Converted to 70	50	100
CIA 2 (Written)	50			
Two Classroom Assessments (Spoken/Skill-based Activities) 2x 15	30	30		
External Examination			Converted to	
Semester Exam (Written)	100	Converted to 40/ (Pass Min. 16)	50	
Semester Viva Voce 4x25 (Spoken)	100	Converted to 10/ (Pass Min. 4)		

Course I

Hours: 6

Course Code: 26UGEL11

Credits: 3

LEARNING OUTCOMES

LO1 To provide an ambience to acquire the basic language skills, listening, speaking, reading, and writing

LO2 To make the learners learn the basic elements of grammar

LO3 To enable them to involve in basic communicative activities

LO4 To develop basic vocabulary

LO5 To help the learners comprehend and respond in English

LO6 To build confidence in using English to communicate

UNIT – I POETRY (READING AND WRITING SKILLS)

1. Sarojini Naidu- “Indian Weavers”
2. Robert Burns – “My Love is like a Red Red Rose”

UNIT – II SHORT STORIES (READING AND WRITING SKILLS)

1. W. Somerset Maugham – “The Ant and the Grasshopper”
2. Guy De Maupassant – “The Necklace”

UNIT –III GRAMMAR AND VOCABULARY SKILLS

1. Use of Verbs: Verb Grid (Positive, Negative & Question), Regular Verbs, Irregular Verbs & Modal
2. Tenses: Active Voice Tenses & Passive Voice Tenses
3. Use of Nouns: Forms of Personal Pronouns, Use of Nouns as Subject, Object, Complement and Object of the Preposition
4. Sentence Patterns: SV, SVO, SVC, SVA, SVOA, SVIODO
5. Punctuation and Capitalisation
6. Reading Comprehension (5 Anecdotes and 5 Wisdom Stories)

UNIT – IV LISTENING AND SPEAKING SKILLS

1. Listening Practice –Listen and Do exercises: Listening to English songs, simple Indian short stories, homonyms/homophones
2. Pronunciation Practice: Vegetables, Fruits, Flowers, Trees, Spices, Eatables
3. Introducing Oneself
4. Introducing Others

UNIT –V LISTENING AND SPEAKING SKILLS

1. Greetings
2. Making Request
3. Reading Aloud (From the text)
4. Describing a place / a picture (With hints)

COURSE OUTCOMES

Learners will be able to

CO1 Use grammatical structures in meaningful constructions

- CO2 Use oral communication for day-to-day activities
 CO3 Use simple sentences for oral and written communication
 CO4 Use punctuation and capitalisation accurately
 CO5 Comprehend what they listen to, and respond to it at the primary level
 CO6 Read and appreciate simple stories and anecdotes

TEXT BOOKS

- *SPARK I: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.
- *Intermediate English Grammar* by Raymond Murphy. Cambridge University Press, 2019.

REFERENCE

- *Spoken English: A Foundation Course* by Kamalesh Sadanand and Susheela Punitha, Orient Longman Private Limited, 2008, ISBN 81-250-3467-6.
- *Spoken English for You* by G. Radhakrishna Pillai and K. Rajeevan, Emerald Publishers, 1987, ISBN 978-81-7966-023-2.
- *Better English Pronunciation* by Thakur KBP Sinha, Vijay Nicole Imprints, 2005, ISBN 81-8209-068-7.
- Bhatnagar, R. P. *English for Competitive Examinations*, India: Trinity Press, 2017
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

QUESTION PATTERN

SEMESTER EXAMINATION

Marks

PART A - MCQs (7 from each of the Units I, II & 6 from Unit III) 20

PART B - Compulsory - Units I, II & III (5X3) 15

- Unit I - Short answer/ ERC
- Unit II - Short answer/ ERC
- Verb Grid (be verb)
- Verb Grid (possessive)
- Verb Grid (action/passive)

PART C – Compulsory- Unit III (5x7) 35

- Use of Verbs: Verb Grid
- Tenses
- Use of Nouns
- Sentence Patterns
- Punctuation and Capitalisation

PART D - (3x10) 30

- Essay (250 words) Unit I (Either/or)
- Essay (250 words) Unit II (Either/or)
- Compulsory -Comprehension

TOTAL

100

INTERNAL EXAMINATIONS		Marks
PART A - MCQs 6X1(2 from each of the Units I, II & III)		6
PART B- Compulsory - one question from each of the Units I, II & III		
1 Short answer/ 1 ERC / Grammar (3X3)		9
PART C –Compulsory (Unit III) (3X5)		15
PART D- (2X10)		20
• Essay - Either /or Units – I & II 250 words		
• Compulsory- Grammar/ Composition		
TOTAL		50

INTERNAL ASSESSMENTS Marks

Skill-based activity - 2x15 30
 (Seminar presentation/Spoken English/Critical Podcast/ Video Essay/ Creating a 5–8 slide on a topic/
 Composing a poem/ Submitting a relevant photo with description, etc.)
TOTAL 30

Viva Voce Components: 100 Marks

1. Introducing Oneself / Others (25)
2. Reading Aloud (From the text) (25)
3. Describing a place / a picture (With hints) (25)
4. Conversation with the examiner (Greetings/ Making Request) (25)

COURSE II

Hours: 6

Course Code: 26UGEL22

Credits: 3

LEARNING OUTCOMES

LO1 To provide an ambience to acquire the basic language skills, listening, speaking, reading, and writing

LO2 To make the learners frame questions and answers

LO3 To enable them to involve in basic communicative activities

LO4 To develop a comprehensible use of adjectives

LO5 To help the learners comprehend and respond in English

LO6 To develop oral communication for day-to-day activities

UNIT – I POETRY (READING AND WRITING SKILLS)

1. Rabindranath Tagore – “Leave this Chanting and Singing”
2. Gerard Manley Hopkins- “God’s Grandeur”

UNIT – II SHORT STORIES (READING AND WRITING SKILLS)

1. Sister Nivedita - “The Judgement Seat of Vikramaditya”
2. Stephen Leacock - “With the Photographer”

UNIT – III GRAMMAR AND VOCABULARY SKILLS

1. Use of Adjectives
2. Use of Conditional ‘If’ (Probable & Improbable Conditions)
3. Use of ‘who’, ‘which’, ‘where’ & ‘that’ in combining sentences
4. Framing questions – ‘Wh –’ & ‘Yes’ / ‘No’ Questions
5. Prefixes and Suffixes
6. Developing Hints into a Paragraph

UNIT – IV LISTENING AND SPEAKING SKILLS

1. Listening Practice – Listen and Do exercises: Sound patterns and words ending ‘s’ endings and ‘d’ endings, and Listening to English songs and Indian short stories
2. Pronunciation Practice: Medical Terms/ Names of Ailments/People /Currency/ Countries and Capitals/World-famous Cities
3. Making Requests
4. Offering help

UNIT – V LISTENING AND SPEAKING SKILLS

1. Seeking Permission
2. Expressing Gratitude
3. Reading Aloud (from the Prescribed Text)
4. Narrating a Story (from Hints)

COURSE OUTCOMES

Learners will be able to

CO1 Use grammatical structures in meaningful contexts

CO2 Use oral communication for day-to-day activities

CO3 Use simple sentences for oral and written communication

CO4 Use enhanced vocabulary

CO5 Comprehend and respond to what they listen to at the secondary level
CO6 Read and appreciate simple pieces of fiction and non-fiction

TEXT BOOKS

- *SPARK II: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.
- *Intermediate English Grammar* by Raymond Murphy. Cambridge University Press, 2019.

REFERENCE

- *Spoken English: A Foundation Course* by Kamalesh Sadanand and Susheela Punitha, Orient Longman Private Limited, 2008, ISBN 81-250-3467-6.
- *Spoken English for You* by G. Radhakrishna Pillai and K. Rajeevan, Emerald Publishers, 1987, ISBN 978-81-7966-023-.
- *Better English Pronunciation* by Thakur KBP Sinha, Vijay Nicole Imprints, 2005, ISBN 81-8209-068-7.
- Bhatnagar, R. P. *English for Competitive Examinations*, India: Trinity Press, 2017.
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

QUESTION PATTERN

SEMESTER EXAMINATION

Marks

PART A – MCQs (7 from each of the Units I, II, and 6 from Unit III)	20
PART B – Compulsory Units I, II & III - Short answers/ ERC/Grammar (5X3)	15
• Unit I - Short answer/ ERC • Unit II - Short answer/ ERC • Prefixes • Suffixes • Adjectives	
PART C – Compulsory Unit III (5x7)	35
• Adjectives • Use of 'who' & 'where' in combining sentences • Use of 'which' & 'that' in combining sentences • Framing questions – 'Wh –' & 'Yes' / 'No' Questions • Developing Hints into a Paragraph	
PART D – (3x10)	30
• Essay (250 words) Unit I (Either/or) • Essay (250 words) Unit II (Either/or) • Compulsory -Use of Conditional 'If' (Probable & Improbable Conditions)	

TOTAL

100

INTERNAL EXAMINATIONS Marks

PART A - MCQs 6X1(2 from each of the Units I, II & Unit III)	6
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COURSE III

Hours: 6

Course Code: 26UGEL13, 26UGEL33

Credits: 3

LEARNING OUTCOMES

LO1 To involve the learners in reading and interpreting English in poetry and prose (Fiction and Non-fiction)

LO2 To enable learners to write about prescribed literature

LO3 To help learners learn the appropriate use of articles, prepositions and adverbs

LO4 To help learners develop vocabulary register through homonyms, homophones and homographs

LO5 To facilitate in learners, the ability to create a narration based on hints

LO6 To build confidence in the learners to speak English for specific purposes

UNIT – I POETRY (READING AND WRITING SKILLS)

1. William Shakespeare – “All the World’s a Stage”
2. P. B. Shelley – “Ozymandias”
3. Oliver Goldsmith – “The Village Schoolmaster”

UNIT – II SHORT STORIES/ PROSE (READING AND WRITING SKILLS)

1. O. Henry – “The Gift of the Magi”
2. Katherine Mansfield – “A Cup of Tea”
3. Mark Twain – “A Day at Niagara”

UNIT – III GRAMMAR AND VOCABULARY SKILLS

1. Articles
2. Prepositions
3. Adverbs
4. Spotting Errors (Articles/ Prepositions / Adverbs)
5. Homonyms, Homophones, Homographs
6. Constructing a story using hints

UNIT –IV LISTENING AND SPEAKING SKILLS

1. Listening Practice: Listen and Do exercises: Listening to short passages , short stories (Indian and British) , English songs, *Mind your Language* (Episodes:1-2)
2. Pronunciation Practice : Words related to professions
3. Words generally mispronounced
4. Telephonic Conversation
5. Making Suggestions

UNIT – V LISTENING AND SPEAKING SKILLS

1. Complimenting / Congratulating
2. Expressing Sympathy
3. Reading aloud
4. Describing a picture/ Describing a process
5. Personal Conversation (Habits, Hobbies, Future Plan)

COURSE OUTCOMES

Learners will be able to

CO1 Read and understand English in poetry and prose (Fiction and Non-Fiction)

CO2 Write coherent essays about the prescribed literature

CO3 Use articles, prepositions and adverbs appropriately

CO4 Use homonyms, homophones, and homographs appropriately, ensuring clarity and precision in their spoken and written English

CO5 Create a narration from hints

CO6 Speak English confidently in a descriptive as well as expository style

TEXT BOOKS

- *SPARK III: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.
- *Intermediate English Grammar* by Raymond Murphy. Cambridge University Press, 2019.

REFERENCE

- *Spoken English: A Foundation Course* by Kamalesh Sadanand and Susheela Punitha, Orient Longman Private Limited, 2008, ISBN 81-250-3467-6.
- *Spoken English for You* by G. Radhakrishna Pillai and K. Rajeevan, Emerald Publishers, 1987, ISBN 978-81-7966-023-2.
- *Better English Pronunciation* by Thakur KBP Sinha, Vijay Nicole Imprints, 2005, ISBN 81-8209-068-7.
- Bhatnagar, R. P. *English for Competitive Examinations*, India: Trinity Press, 2017.
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

QUESTION PATTERN

SEMESTER EXAMINATION

Marks

PART A - MCQs (7 from each of the Units I, II, and 6 from Unit III)

20

PART B - Compulsory - Units I, II & III (5X3)

15

- Unit I - Short answer/ ERC
- Unit II - Short answer/ ERC
- Articles
- Prepositions
- Adverbs

PART C – Compulsory - Unit III (5x7)

35

- Articles
- Prepositions
- Adverbs
- Homonyms, Homophones, Homographs
- Constructing a story using hints

PART D - (3x10)

30

- Essay (250 words) Unit I (Either/or)

- Essay (250 words) Unit II (Either/or)
- Compulsory -Spotting Errors (Articles/ Prepositions / Adverbs)

TOTAL **100**

INTERNAL EXAMINATIONS

Marks

PART A - MCQs 6X1(2 from each of the Units I, II &Unit III)

6

PART B- Compulsory one question from each of the Units I, II & III

1 Short answer/ 1 ERC/ Grammar (3X3)

9

PART C – Compulsory- (Unit III) (3X5)

15

PART D- (2X10)

20

- Essay - Either /or Units – I & II 250 words

- Compulsory- Grammar/ Composition

TOTAL

50

INTERNAL ASSESSMENTS Marks

Skill based activity – 2x15 30

(Seminar presentation/Spoken English/Critical Podcast/ Video Essay/ Creating a 5–8 slide on a topic/
Composing a poem/ Submitting a relevant photo with description etc.)

TOTAL 30

Viva-Voce Components: 100 Marks

1. Pronunciation: Words related to professions /Words generally mispronounced (25)
2. Conversation: Making Suggestions /Complimenting / Congratulating /Expressing Sympathy /
Habits, Hobbies, Future Plan (25)
3. Reading aloud (25)
4. Describing a picture/ Describing a process (25)

COURSE IV

Hours: 6

Course Code: 26UGEL14, 26UGEL24, 26UGEL44

Credits: 3

LEARNING OUTCOMES

LO1 To make learners read and understand intermediate level poetry and prose

LO2 To encourage learners to continue building a vocabulary register as the students interpret, speak, and write about prescribed literature

LO3 To make learners use tenses and concord in meaningful constructions

LO4 To enable learners to employ appropriate synonyms and antonyms in written and spoken communication

LO5 To help learners learn the different types of letters, resumes and the art of composing e-mails and the use of appropriate language

LO6 To build confidence in students to speak English naturally and clearly, moving from basic sounds and reading practice to advanced conversations about books and real-world issues

UNIT – I POETRY (READING AND WRITING SKILLS)

1. John Milton – “On His Blindness”
2. Lewis Carroll – “The Walrus and the Carpenter”
3. Rudyard Kipling – “If”

UNIT – II SHORT STORIES /DRAMA (READING AND WRITING SKILLS)

1. Rabindranath Tagore – “The Postmaster”
2. Ernest Hemingway– “Cat in the Rain”
3. Fritz Karinthy –“The Refund”

UNIT – III GRAMMAR AND VOCABULARY SKILLS

1. Tenses
2. Concord
3. Spotting Errors (Tenses and Concord)
4. Describing a thing / a place / an event
5. Synonyms and Antonyms (Bhatnagar)
6. Letter Writing (Formal & Informal), Resumes and Composing emails

UNIT – IV LISTENING AND SPEAKING SKILLS

1. Listening Practice: Listen and Do exercises: Listening to conversations, announcements, interviews of popular personalities, and *Mind your Language* (Episodes: 3-4)
2. Complaining
3. Apologising
4. Offering encouragement and responding to them
5. Warning Someone

UNIT –V LISTENING AND SPEAKING SKILLS

1. Pronunciation Practice: Vowels and Diphthongs & Strong and Weak forms of words
2. Reading Aloud
3. Issue-based conversation

4. Speaking about prescribed literature
5. Speaking on a given topic

COURSE OUTCOMES

Learners will be able to

CO1 Read, interpret, and analyse intermediate level of English in poetry, prose, and fiction

CO2 Write coherent essays on prescribed literature

CO3 Use the various tense forms accurately with proper subject - verb agreement

CO4 Compose logically organized descriptive paragraphs, formal letters, professional resumes and emails

CO5 Use synonyms and antonyms appropriately, allowing for more expressive, varied, and accurate communication

CO6 Speak English fluently with confidence in an expository as well as analytical style

TEXTBOOKS

- *SPARK IV: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.
- *Intermediate English Grammar* by Raymond Murphy. Cambridge University Press, 1999.

REFERENCE

- *Spoken English: A Foundation Course* by Kamalesh Sadanand and Susheela Punitha, Orient Longman Private Limited, 2008, ISBN 81-250-3467-6.
- *Spoken English for You* by G. Radhakrishna Pillai and K. Rajeevan, Emerald Publishers, 1987, ISBN 978-81-7966-023-2.
- *Better English Pronunciation* by Thakur KBP Sinha, Vijay Nicole Imprints, 2005, ISBN 81-8209-068-7.
- Bhatnagar, R. P. *English for Competitive Examinations*. India: Trinity Press, 2017.
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

QUESTION PATTERN

SEMESTER EXAMINATION	Marks
PART A - MCQs (7 from each of the Units I, II, and 6 from Unit III)	20
PART B- Compulsory- Units I, II & III (5X3)	15
• Unit I - Short answers/ ERC • Unit II - Short answers/ ERC • Tenses • Concord • Spotting Errors (Tenses and Concord)	
PART C – Compulsory- Unit III (5x7)	35
• Tenses	

• Concord • Spotting Errors (Tenses and Concord) • Describing a thing / a place / an event • Synonyms(4) and Antonyms(3)	
PART D - (3x10)	30
• Essay (250 words) Unit I (Either/or) • Essay (250 words) Unit II (Either/or) • Compulsory- Letter Writing/Resumes/ Composing emails	
TOTAL	100
INTERNAL EXAMINATIONS	Marks
PART A - MCQs 6X1(2 from each of the Units I, II & Unit III)	6
PART B- Compulsory one question from each of the Units I, II & III 1 Short answers/ 1 ERC/ Grammar (3X3)	9
PART C –Compulsory (Unit III) (3X5)	15
PART D- (2X10)	20
• Essay - Either /or Units – I & II 250 words • Compulsory- Grammar/ Letter writing/ Composition	
TOTAL	50

INTERNAL ASSESSMENTS Marks

Skill based activity – 2x15	30
(Seminar presentation/Spoken English/Critical Podcast/ Video Essay/ Creating a 5–8 slide on a topic/ Composing a poem/ Submitting a relevant photo with description, etc.)	
TOTAL 30	

Viva-Voce Components: 100 Marks

1. Reading Aloud (25)
2. Issue-based conversation (25)
3. Speaking about prescribed literature (25)
4. Speaking on a given topic (25)

COURSE V

Hours: 6

Course Code: 26UGEL25, 26UGEL35

Credits: 3

LEARNING OUTCOMES

LO1 To introduce learners to the intermediate level of English through prescribed literature

LO2 To make learners read, interpret, and write about prescribed pieces of literature

LO3 To make learners learn complex language structures, the appropriate use of conjunctions and voice forms

LO4 To help learners become familiar with the accurate use of language with an awareness of common errors in language use

LO5 To make learners understand the logical sequence of ideas within a paragraph

LO6 To make learners speak English fluently with confidence, argue both sides of a topic with confidence, and discuss difficult modern issues with logic and ease

UNIT – I POETRY (READING AND WRITING SKILLS)

1. William Wordsworth – “The Solitary Reaper”
2. H.W. Longfellow – “A Slave’s Dream”
3. Robert Frost – “The Road Not Taken”

UNIT – II PROSE/ DRAMA (READING AND WRITING SKILLS)

1. Oscar Wilde - “The Model Millionaire”
2. A. A. Milne – “The Boy Comes Home”
3. Francis Bacon – “Of Friendship”

UNIT – III GRAMMAR SKILLS

1. Synthesis and Transformation of Sentences (Simple, Compound & Complex)
2. Conjunctions
3. Active – Passive Voice
4. Spotting Errors (Simple, Compound & Complex sentences/ Conjunctions/ Active – Passive Voice)

UNIT – IV ADVANCED WRITING/ VOCABULARY AND ANALYTICAL SKILLS

1. Expansion of Ideas / Proverbs
2. Dialogue Writing
3. Words often confused (Bhatnagar)
4. Sentence Arrangement

UNIT – V LISTENING AND SPEAKING SKILLS

1. Listening Practice - Listen and Do exercises: Listening to news reading, directions, stories in American English, and watching movies

2. Pronouncing Words ending with common Inflections (like – ‘logy’ ‘- graphy’ ‘-ation’ etc.),
Pronouncing ‘R’ in different positions
3. Reading and Interpreting
4. Turncoat
5. Expand a Proverb
6. Issue-Based Conversation

COURSE OUTCOMES

Learners will be able to

CO1 Read, interpret and analyse poetic English to understand open possibility of inferences

CO2 Write logically planned essays to address specific questions concerning prescribed literature

CO3 Understand the forms and structural differences in different types of sentences and their specific purposes

CO4 Use complex language structures with appropriate conjunctions and voice forms

CO5 Use vocabulary actively with an awareness of words often confused

CO6 Use Spoken English fluently with confidence and accuracy for specific purposes such as analytical, argumentative, and expository talks

TEXT BOOKS

- *SPARK V: An Integrated Course Text for General English*, Department of English, St. Xavier’s College (Autonomous), Palayamkottai.
- *Intermediate English Grammar* by Raymond Murphy. Cambridge University Press, 1999.

REFERENCE

- *Spoken English: A Foundation Course* by Kamalesh Sadanand and Susheela Punitha, Orient Longman Private Limited, 2008, ISBN 81-250-3467-6.
- *Spoken English for You* by G. Radhakrishna Pillai and K. Rajeevan, Emerald Publishers, 1987, ISBN 978-81-7966-023-2.
- *Better English Pronunciation* by Thakur KBP Sinha, Vijay Nicole Imprints, 2005, ISBN 81-8209-068-7.
- Bhatnagar, R. P. *English for Competitive Examinations*. India: Trinity Press, 2017.
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

QUESTION PATTERN

SEMESTER EXAMINATION

Marks

PART A - MCQs (8 from Unit I, 7 from Unit II, and 5 from Unit III)	20
PART B- Compulsory Units I & II – 3 Short answers/ 2 ERC (5X3)	15
PART C – Compulsory - Unit III & IV (5x7)	35

- Synthesis and Transformation of Sentences (Simple, Compound & Complex)
- Conjunctions
- Active – Passive Voice
- Expansion of Ideas / Proverbs
- Words often confused

PART D - (3x10)

30

- Essay (250 words) Unit I & II (Either/or)
- a) Dialogue Writing (5) b) Sentence Arrangement (5)
- Compulsory -Spotting Errors (Simple, Compound & Complex sentences/ Conjunctions/ Active – Passive Voice)

TOTAL

100

INTERNAL EXAMINATIONS Marks

PART A - MCQs 6X1(1 from Units I & II , 5 from Units III & IV)

6

PART B- Units I & II – 2 Short answers/ 1 ERC (3X3)

9

PART C –Compulsory (Units III & IV) (3X5)

15

PART D- (2X10)

20

- Essay - Either /or Units – I & II 250 words
- Compulsory -Grammar/ Letter writing/ Composition

TOTAL

50

INTERNAL ASSESSMENTS Marks

Skill based activity – 2x15 30

(Seminar presentation/Spoken English/Critical Podcast/ Video Essay/ Creating a 5–8 slide on a topic/ Composing a poem/ Submitting a relevant photo with description, etc.)

TOTAL 30

Viva-Voce Components: 100 Marks

1. Reading and Interpreting (25)
2. Turncoat (25)
3. Expand a Proverb (25)
4. Issue-Based Conversation (25)

COURSE VI

Hours: 6

Course Code: 26UGEL36, 26UGEL46

Credits: 3

LEARNING OUTCOMES

LO1 To introduce learners to the advanced level of poetic English through representative pieces, to make them understand the oblique use of language

LO2 To make them read and understand classical English novel

LO3 To familiarise them with advanced language structures and the use of idioms and phrasal verbs

LO4 To make them understand and use different degrees for comparison, and use language for reporting speech

LO5 To acquaint them with the skills of expanding or developing, condensing ideas and responding to advertisements

LO6 To make them organize their professional knowledge into clear speeches, and discuss important world issues with confidence and logic

UNIT –I POETRY (READING AND WRITING SKILLS)

1. John Keats – “La Belle Dame Sans Merci”
2. John Donne – “Death Be Not Proud”
3. Walt Whitman – “O Captain! My Captain!”

UNIT - II FICTION (READING AND WRITING SKILLS)

George Orwell –*Animal Farm*

UNIT – III GRAMMAR AND VOCABULARY SKILLS

1. Degrees of Comparison
2. Direct- Indirect Speech
3. Spotting Errors/Correcting Errors (Comprehensive)
4. Idioms and Phrasal Verbs (Bhatnagar)

UNIT – IV ADVANCED WRITING AND ANALYTICAL SKILLS

1. Précis Writing
2. Essay Writing
3. Responding to the given advertisement
4. Cloze Test

UNIT – V LISTENING AND SPEAKING SKILLS

1. Listening Practice - Listen and Do exercises: Listening to famous speeches, poetry renditions, sports commentary, and TED Talks
2. Pronunciation Practice: Words generally often mispronounced
3. Reading and Interpretation
4. Issue-Based Conversation
5. Public speaking on a subject topic

6. Extempore

COURSE OUTCOMES

Learners will be able to

CO1 Read and interpret the oblique language of poetry and write appreciative essays on the prescribed literature

CO2 Read, interpret, and write analytical essays about prescribed literature

CO3 Use advanced grammar structures to report speech and use the three degrees of comparison for intended emphasis

CO4 Use advanced nuances of language such as idioms and phrasal verbs

CO5 Write reflective, descriptive, expository and imaginative essays with appropriate content, and condense material to a précis

CO6 Use English fluently and accurately for public speaking, extempore and other specific purposes

TEXT BOOKS

- *SPARK VI: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.
- Orwell, George. *Animal Farm*. Maple Classics, 2013.
- *Intermediate English Grammar* by Raymond Murphy. Cambridge University Press, 1999.

REFERENCE

- *Spoken English: A Foundation Course* by Kamalesh Sadanand and Susheela Punitha, Orient Longman Private Limited, 2008, ISBN 81-250-3467-6.
- *Spoken English for You* by G. Radhakrishna Pillai and K. Rajeevan, Emerald Publishers, 1987, ISBN 978-81-7966-023-2.
- *Better English Pronunciation* by Thakur KBP Sinha, Vijay Nicole Imprints, 2005, ISBN 81-8209-068-7.
- Bhatnagar, R. P. *English for Competitive Examinations*. India: Trinity Press, 2017.
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

QUESTION PATTERN

SEMESTER EXAMINATION

	Marks
PART A - MCQs (7 from Unit I, 8 from Unit II, and 5 from Unit III)	20
PART B – Compulsory -2 ERC from Unit I / 3 Short answers from Units II	15
PART C – Compulsory- Unit III & IV (5x7)	35
• Degrees of Comparison	
• Direct- Indirect Speech	
• Précis Writing	
• Essay Writing	
• Responding to the given advertisement	
PART D - (3x10)	30
• Essay (250 words) Unit I & II (Either/or)	
• Compulsory- Spotting Errors (5) Correcting Errors(5) (Comprehensive)	
• Compulsory- a) Idioms and Phrasal verbs (5) b) Cloze Test (5)	
TOTAL	100

INTERNAL EXAMINATIONS	Marks
PART A - MCQs 6X1(1 from Units – I & II , 5 from Units III)	6
PART B- Compulsory Units I & II	
1 ERC from Unit I /2 Short answers from Units I & II (3X3)	9
PART C –Compulsory (Unit III & IV) (3X5)	15
PART D- (2X10)	20
• Essay - Either /or Units – I & II 250 words • Compulsory- Grammar/ Composition	
TOTAL	50

INTERNAL ASSESSMENTS Marks

Skill based activity - 2x15 30
 (Seminar presentation/Spoken English/Critical Podcast/ Video Essay/ Creating a 5–8 slide on a topic/
 Composing a poem/ Submitting a relevant photo with description, etc.)
TOTAL 30

Viva-Voce Components: 100 Marks

1. Reading and Interpretation (25)
2. Issue Based Conversation (25)
3. Public speaking on subject related topic (25)
4. Extempore (25)

LEARNING OBJECTIVES

LO1 To facilitate learners' reading advanced English through representative pieces of Literature

LO2 To help learners infer and interpret prescribed literature and write coherent, analytical essays

LO3 To help learners analyse a selected dramatic scene to identify how dialogue and stage directions reveal character motivation and advance the central conflict

LO4 To encourage learners in using English skillfully and creatively to discuss, brainstorm or debate a topic, through active practice

LO5 To equip learners with the soft skills necessary for employability

LO6 To help learners to produce structured reports, engaging blogs and original creative pieces by adapting their writing style to suit different purposes and audiences

UNIT –I DRAMA (READING AND WRITING SKILLS)

1. *Julius Caesar* – Act III, Scene I

2. *Othello* – Act V, Scene II

3. *Hamlet*- Act I, Scene III

UNIT –II FICTIONS (READING AND WRITING SKILLS)

H. G. Wells –*Time Machine*

UNIT –III SOFT SKILLS AND SPEAKING SKILLS (Theory and Practice)

1. Interview Skills*

2. Group Discussion*

3. Debate*

4. Interpersonal Skills*

(* Included for Spoken English Viva Voce and Internal Assessments)

UNIT –IV SOFT SKILLS

1. Time Management

2. Problem-Solving Techniques

3. Teamwork

4. Leadership

UNIT –V ADVANCED WRITING SKILLS

1. Report Writing

2. Blog writing

3. Creative Writing (poem/short story)

COURSE OUTCOMES

Learners will be able to

CO1 Read and understand advanced forms of English in Literature

CO2 Interpret and write analytical essays on topics concerning prescribed pieces of literature

CO3 Speak English fluently and accurately in professional contexts

CO4 Use English effectively and creatively for interviews, group discussions, etc.

CO5 Behave, react, and handle situations connected to employability, using the acquired knowledge of soft skills

CO6 Demonstrate versatility in written communication by producing structured technical reports, engaging digital content for blogs, and original creative works that employ evocative language and narrative techniques

TEXT BOOKS

- *SPARK VII: An Integrated Course Text for General English*, Department of English, St. Xavier's College (Autonomous), Palayamkottai.
- Wells, H. G. *Time Machine*. Oxford University Press, 2017 Ed.
- Alphonse S. J., Xavier. *We Shall Overcome: A Textbook on Life Coping Skills*. ICRDDCE Publication, 2004.

REFERENCE

- Sijwalii B.S. and Indu Sijwali, *General Interview Skills for Both Government and Private Sectors*. Arihant Publications, 2023.
- Soman, Ashok M, *Graduates and Postgraduates Entering the Corporate World*. Himalaya Publishing House, 2023.
- Patnaik, Priyadarshi, *Communication, Logical Thinking, and Public Speaking*. Cambridge University Press, India, 2016.

QUESTION PATTERN

SEMESTER EXAMINATION	Marks
PART A - MCQs (5 from each of the Units I, II, III & IV)	20
PART B- Compulsory - (5X3) ERC from Unit I/ Short answers from Units II, III & IV	15
• Unit I • Unit II • Units III • Units IV • Units III/ IV	
PART C –Compulsory- Units I, II, III, IV & V (5x7)	35
• Short Essay (200 words)/ Annotation Unit I • Short Essay Unit II (200 words) • Short Essay Unit III (200 words) • Short Essay Unit IV (200 words) • Creative Writing (poem/short story)	
PART D - (3x10)	30
• Essay (250 words) Unit I & II (Either/or) • Compulsory -Report writing (250 words) • Compulsory - Blog writing (250 words)	
TOTAL	100

INTERNAL EXAMINATIONS		Marks
PART A - MCQs 6X1 (1 from Units I & II , 5 from Units III & IV)		6
PART B- Units I & II – 2 Short answers from Units I & II/ 1 ERC from Unit I (3X3)		9
PART C –Compulsory (Unit III & IV) (3X5)		15
PART D- (2X10)		20
1. Essay - Either /or Units – I & II 250 words		
2. Compulsory - Report writing / Blog writing/ Creative Writing (Unit V)		

TOTAL **50**

INTERNAL ASSESSMENTS Marks

Skill based activity – 2x15 30
 (Seminar presentation/ Video Essay/ Creating a 5–8 slide on a topic/ writing a poem, short story/Mock Interview /Group Discussion/Debate etc.)

TOTAL 30

Viva-Voce Components: 100 Marks

1. Interview Skills: Mock Interview (25)
2. Group Discussion (25)
3. Debate (25)
4. Interpersonal Skills: Conversation (25)

DEPARTMENT OF HUMAN EXCELLENCE
St. Xavier's College (Autonomous), Palayamkottai
Courses Offered

Semester	Category	Course Code	Course Title
I	FC	26UHER11/ 26UHEE11	Religion: Catholic Doctrine / Ethics
II	SEC3	26UHEI21	Integrated Personality Development
III	SEC4	26UHEL31	Life Coping and Entrepreneurial Skills Management
IV	EVS	26UEVS41	Environmental Studies
V	VE	26UVEH51	Human Rights and Social Analysis

NME

Semester	Category	Course Code	Course Title
I	Library	26ULBN11	Foundations of Library Science
I	XRF	26UXRN11	Traditional Knowledge of Indian Medicinal Systems
II	Library	26ULBN21	Information Resources
II	STAND	25USTN21	Rural Development Studies
II	XRF	26UXRN21	Indian Traditional Medicinal Foods
III	XRF	26UXRN31	Food Microbiology
IV	XRF	26UXRN41	Herbal Resources and Their Conservation
IV	MAX Forum	26UMXN41	Society, Economy and Politics in Contemporary India

Common Question Pattern

Internal Test

Part A	Answer ALL the questions in one or two lines	5 x 2 = 10
Part B	Answer ALL the questions, each in a paragraph	3 x 5 = 15
Part C	Write an essay on the following	1 x 10 = 10

Semester Exam

Part A	Answer ALL the questions in one or two lines	10 x 3 = 30
Part B	Answer ALL the questions, each in a paragraph	5 x 8 = 40
Part C	Write an essay on each the following	2 x 15 = 30

RELIGION: CATHOLIC DOCTRINE
(26UHER11)

SEMESTER:I	VE	HOURS:2	CREDITS: 2	TOTALHOURS:30
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Course Outcomes:

Upon completion of the course the students will be able to

CO1: Recite the Sacraments (K1)

CO2: Identify the challenges of the present day church (K1)

CO3: Associate Old and New testaments of the bible (K2)

CO4: Explain the Church history (K2)

CO5: Discuss the Marian worship (K2)

CO6: Summarize the catholic social teachings (K2)

Unit I: Introduction to Bible (6 Hours)

Bible as a Word of God, its inspiration, the Canon - Old and New Testaments and their interconnectedness - Traditional and modern interpretations

Unit II: Jesus and His Teachings (6 Hours)

Parables of Jesus – Important Teachings of Jesus: Kingdom of God – God’s Mercy – Trust in Providence – Two Commandments of love – Be committed – No condemnation of wealth – No condemnation of sinners – Love of enemies; Prayer: Jesus’ Prayer – Types of Prayer; Jesus the Healer – Types of Miracles of Jesus – Jesus the Liberator

Unit III: A Brief History of the Church & Changes and Challenges of the Modern World

(6 Hours)

The beginnings of the Church - Medieval period and its challenges - The importance of the Second Vatican Council and their decrees – Synodality; Casteism – Ecumenical unity and Inter Religious harmony – Digital world and Religious Faith - Catholic Social Teachings

Unit IV: Introduction to the Sacraments and Trinity (6 Hours)

The origin of the seven sacraments - Their practices and meanings – Trinity: The Father – The Son and the Holy Spirit

Unit V: Introduction to Mariology (6 Hours)

Mary, Mother of God and Jesus - Mary, our Mother and in the Gospels - Mariology in the history of the Church – Mary as a Prophet of revolution

REFERENCES:

- “Faith Matters” material prepared by the Department of Human Excellence.
- Second Vatican Council Documents.

**ETHICS
(26UHEE11)**

SEMESTER:I	VE	HOURS:2	CREDITS: 2	TOTALHOURS:30
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Course Outcomes

After completing this course, the learner will be able to know/understand: Cognitive Level

(K-Level)

CO-1 Describe the Ethical foundations and human values (K2)

CO-2 Identify Ethics and its relationship with religions (K1)

CO-3 Evaluate the personal ethical codes in day-to-day life (K5)

CO-4 Associate ethics in family and society (K3)

CO-5 Apply moral, professional, and personal ethics in academic, workplace, and daily life situations. (K3)

CO-6 Analyse the modern ethical issue (K4)

Unit-I Introduction to Ethics and Human Interface

(6 Hours)

Meaning, Nature and Scope of Ethics-Challenges and Importance of ethics-Basic ethical foundations-Human values: Tolerance, Compassion, Rationality, Objectivity. Scientific Attitude, Integrity, Respecting Conscience and Empathy. Mahatma Gandhi and Ethical practices: Non violence, Truth, Non-hatred and love for all, concern for the poorest, objectivity nationalism and Education for man making relation between ends and means.

Unit-II Ethics and Major religions and civilizations

(6 Hours)

Ethics and its relationship with Religions- Ten Commandments: Christianity and Judaism tradition-Hinduism- Dharma and Mokhya (out of 4 goals of life Dharma, Artha, Kama and Mokhya),concept of Purusartha, Nisakama Karma (work without attachment to results), Concept of Basudev Kutumba and Peace(Whole including all animals, plants, inanimate beings and human form one world)-Islamic Ethics: Justice, Goodness, Kindness, Forgiveness, Honesty, Purity and piety- Buddhism - Arya AstangikaMarg: Right view, Thought , Speed, Action, Livelihood, Efforts, Attention and Concentration.

Unit-III Personal and Professional ethics

(6 Hours)

Moral percepts -Dynamics of personal morality-Moral Conscience-Ethical aspects of Thirukural-Evils of corruption- Professional ethics- Nature, Characteristics, scope, type. Professional Value: Trusteeship, Inclusiveness, Commitment, Sustainability, Accountability, Transparency, Impartiality.

Unit-IV Governance, Family and Social Ethics

(6 Hours)

Concept of Good Governance-Principles: Transparency, Accountability, Rule of Law-Ethical Leadership and Public Responsibility-Corruption and Integrity in Public Life-Role of Family in ethical formulations-Respecting persons-Peace and Justice-Human Duties-Respecting Persons and Human Dignity-Equality, Justice and Fairness -Peace, Non-violence and Social Harmony-Tolerance, Pluralism and Social Inclusion.

Unit- V Judicious Use of Technology

(6 Hours)

Judicious use of Mobile Phones, Electrical machines, Plastics, Television, Computers and their harmful effects. Ethics and Use of Digital Technology: Cyber ethics-, Ethics of social media: WhatsApp, Face book, Twitter and others.

Recommended Books/e-resources:

- R.R. Gaur, R Sangal, G.P. Bagaria (2009): A Foundation Course in Human Values and Professional Ethics, Excel Books.
- D.R. Kiran (2014) Professional Ethics and Human Values, McGraw Hill Education (India).
- Vivian L Vignoles (2017): Identity: Personal and Social, Chapter to appear in Oxford Handbook of Personality and Social Psychology (2nded.), edited by Kay Deaux and Mark Snyder.
- https://cdn.visionias.in/value_added_material/3b896-ethics.pdf

- Sargolzaei, E., & Nikbakht, M. (2017). The Ethical and Social Issues of Information Technology: A Case Study. *International Journal of Advanced Computer Science and Applications*, 8(10), 138–146. <https://doi.org/10.14569/ijacsa.2017.081019>
- Mirghaderi, L., Sziron, M., & Hildt, E. (2023). Ethics and Transparency Issues in Digital Platforms: An Overview. *AI* (Switzerland), 4(4), 831–843. <https://doi.org/10.3390/ai4040042>
- Müller, V. C. (2022). The History of Digital Ethics. Digital Dreams Have Become Nightmares: What We Must Do. <https://doi.org/10.1145/3640479.3640499>
- Course Material Prepared by Department of Human Excellence.

**INTEGRATED PERSONALITY DEVELOPMENT
(26UHEI21)**

SEMESTER: II	SEC3	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30
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Course Outcomes:

After completing this course, students will be able to:

CO1: Analyze individual personality traits, habits, and attitudes by utilizing self-awareness frameworks such as SWOC and the Johari Window. (K4)

CO2: Formulate actionable plans to build self-confidence, a positive mindset, and healthy self-esteem for continuous personal growth. (K6)

CO3: Implement self-management techniques, including mindfulness, yoga, and distraction control, to regulate stress and improve discipline. (K3)

CO4: Demonstrate effective interpersonal skills, including rapport building, assertiveness, and conflict management, within group discussions and team environments. (K3)

CO5: Design a systematic roadmap of realistic personal and academic goals using structured goal-setting methodologies. (K6)

CO6: Integrate ethical values, social responsibility, and gender sensitivity into professional conduct and real-life decision-making. (K4)

UNIT-I: Self-Knowledge (6 Hours)

Exploring Habits, Attitudes, Self Awareness – Self introspection - SWOC analysis – Johari Window’s Self identity. Enhancing one’s Self image, Self -Esteem, Building self Confidence and Positive Mind Set.

UNIT-II: Self Management (6 Hours)

Understanding of One’s Life Story- Focusing on Internal Narratives – Self-Talk, Self-Discipline- Managing Change, -Adaptation to change, Managing Distractions, Yoga and Mindfulness -Overcoming Inferiority Complex

UNIT-III: Personal Competence and Goal Setting (6 Hours)

Developing Rapport - Giving and Receiving Constructive Feedback - Assertiveness and Conflict Management Skills - Group Discussion Skills –Goal Setting.

UNIT-IV: Personality Development (6 Hours)

Recognizing the growth in different dimension of Holistic and Integrated Personality Development-Ethical Behavior-Gender Sensitivity and Respect- Civic Responsibility-Social Media Responsibility

UNIT-V: Emotional Well-Being (6 Hours)

Meaning -Types of Emotions- Expressing Emotions- Managing Difficult Emotions - Self-Control-Healthy Relationships- Building Resilience & Coping Skills - -Mental Health Awareness.

Reference Books:

1. Dr.Xavier Alphonse S.J ,We Shall Overcome, ICRDEC Publications,Chennai,2004.
2. Harold R Wallace and L. Ann Masters, Personality Development South- Western Cengage Learning India PL,NewDelhi,2006.
3. Course Material Prepared by Department of Human Excellence.

LIFE COPING AND ENTREPRENEURIAL SKILLS MANAGEMENT
(26UHEL31)

SEMESTER:III	SEC 4	HOURS:2	CREDITS:2	TOTAL HOURS:30
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Course Outcomes:

After completion of the Course, the students will be able to

- CO1:** Explain holistic health including physical, mental, and social wellbeing. (K2)
- CO2:** Apply healthy lifestyle practices including nutrition, hygiene, and digital wellbeing. (K3)
- CO3:** Analyze social and professional situations using empathy and ethical reasoning. (K4)
- CO4:** Apply structured decision-making and problem-solving skills in real-life situations. (K3)
- CO5:** Demonstrate coping strategies for stress, crisis, and uncertainty. (K3)
- CO6:** Evaluate addiction risks and design strategies for a healthy lifestyle. (K5)

Unit I: Holistic Health & Lifestyle Management (6 Hours)

WHO's definition of Health – Dimensions of Health – Adolescent Health and Women's Health – Understanding Physical Self – Personal Hygiene and Grooming – Balanced Diet and Nutrition – Healthy Habits and Lifestyle – Lifestyle Diseases and Prevention – Digital Wellbeing (Screen Time, Sleep Cycle, Mental Balance) – Public Health Awareness.

Unit II: Social Intelligence & Relationship Management (6 Hours)

Family Relationship: Values in family relationship, nuclear family, Joint Family, Dependence, Overdependence, Happy family, Broken Family - Caring Elders - Rapport Building with Peers/ Friends, Strangers, Transgenders - Professional Relationship: Officials, Mentors, Staff & Service Personnel- Other centeredness and others point of view and Empathy.

Unit III: Decision-Making & Problem-Solving Skills (6 Hours)

Types of Problems (Academic, Personal, Financial, Social) – Problem-Solving Strategies – Decision-Making Process – Rational and Intuitive Decision-Making – Ignatian Discernment Process – Lateral Thinking and Creativity – Basic Financial Literacy (Needs vs Wants, Saving, Budgeting).

Unit IV: Coping with Stress, Crisis & Change (6 Hours)

Meaning and Types of Stress – Causes of Stress (Academic, Social, Digital) – Stress Management Techniques – Emotional Regulation Strategies – Time Management and Productivity – Crisis Management (Failure, Uncertainty, Loss) – Building Resilience and Adaptability.

Unit V: Addiction Awareness & Personal Safety (6 Hours)

Meaning and Types of Addiction – Substance Addiction – Digital and Internet Addiction – Causes and Effects of Addiction – Prevention and Control Measures – Self-Regulation Techniques – Cyber Safety and Responsible Internet Usage – Seeking Help and Counselling Support.

Activity Collaborators: Anti-drug Club, Women's Forum.

Reference Books:

1. Dr. Xavier Alphonse S.J., We Shall Overcome, ICRDEC Publications, Chennai, 2004.
2. Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
3. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.
4. Clear, James. 2018. Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones. New York: Avery
5. Atomic Habits – James Clear, Avery, 2018.
6. The 7 Habits of Highly Effective People – Stephen R. Covey, Free Press.
7. Emotional Intelligence – Daniel Goleman, Bantam Books.
8. Thinking, Fast and Slow – Daniel Kahneman, Penguin Books.
9. Course Material prepared by the Department of Human Excellence.

ENVIRONMENTAL STUDIES
(26UEVS41)

SEMESTER:IV	EVS	HOURS:2	CREDITS:2	TOTAL HOURS:30
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Course Outcomes:

The students will be able to:

CO1: Describe various natural resources and the fundamental principles of sustainable development to explain resource interdependence. (K1)

CO2: Explain the relationship between biodiversity and various conservation approaches to maintain ecological balance. (K2)

CO3: Apply prevention and mitigation strategies to address specific environmental issues and ecosystem degradation. (K3)

CO4: Illustrate the adverse health impacts of different types of pollution on human populations and ecosystems. (K3)

CO5: Evaluate environmental quality indicators and the effectiveness of climate change mitigation risks. (K5)

CO6: Summarize major international environmental treaties and national legislations aimed at environmental protection. (K2)

Unit I: Natural Resources (6 Hours)

Environment – Definition; Overview of natural resources: definition, types of natural resources. Biotic and abiotic, renewable and non-renewable resources. Water resources: types, over-exploitation, issues, challenges, water scarcity, conflicts. Soil and mineral resources: important minerals, problems, soil as a resource. Energy resources: sources, conventional and non-conventional, implications. (IKS- Traditional water conservation methods (e.g., temple tanks, ooranis, johads). Indigenous agricultural practices and soil conservation methods.)

Unit II: Environmental pollution and Health (6 Hours)

Natural and man-made disasters and their impacts of environment and management. Pollution: definitions, natural and man-made pollution. Different types of pollution- Air, Water, Soil, Noise, Radioactive and solid waste pollution: Sources of pollution, different types of pollutants, effects of pollution in environment and human health, prevention and control of pollution. (IKS- Traditional waste management practices. Herbal and indigenous methods to reduce pollution impacts.)

Unit III-Conservation of Biodiversity and Ecosystems (6 Hours)

Biodiversity and its distribution: Levels and types, India and world, hotspots, threat categories. Ecosystems and ecosystem services: major types in India, basic characteristics, significance. Threats to biodiversity and ecosystems: land use, commercial exploitation of species and invasive species. Types of Biodiversity conservation (*In-situ and Ex-situ*). (IKS- Sacred groves and community-based conservation practices, Role of indigenous communities in biodiversity protection)

Unit IV: Climate change: Impacts, Adaptation and Mitigation (6 Hours)

Climate change: structure and different layers of atmosphere, Impacts, vulnerability and adaptation to climate change. Mitigation of climate change: GHGs types, sources, impacts and control. Importance of 1.5 °C and 2.0 °C Global warming and Ozone depletion. Concept of carbon intensity, energy intensity and carbon neutrality; policy instruments, carbon capture and storage, climate justice. Anthropogenic factors - Human over population, over consumption, pollution, Mining, Transport, Environmental degradation and Impact of human activities. (IKS- Traditional climate-resilient farming practices. Indigenous housing designs for climate adaptation.)

Unit V: Environmental Treaties, Legislation and Sustainable Development (6 Hours)

Overview of instruments of international cooperation: bilateral, multilateral, conventions and protocols, COPs. Major International Environmental Agreements: CBD, CITES, UNCCD, UNFCCC. Major Indian Environmental Legislations: acts, rules, sites, areas, zones and judgments. Introduction to sustainable development: SDGs, targets and indicators,

challenges and strategies. Principle of sustainable development, international efforts of sustainable development and sustainable development in India: Perspective and strategies. (IKS- Community based natural resource management models.)

Skill-Based Activities:

Unit-I	➤ Field observation of local water bodies ➤ Preparation of a household resource audit report ➤ Case study analysis on sustainable practices
Unit-II	➤ Air and water quality observation survey ➤ Preparation of eco-friendly products (natural cleaners, composting) ➤ Awareness campaign design
Unit-III	➤ Biodiversity documentation of campus/local area ➤ Preparation of herbarium or digital biodiversity register
Unit-IV	➤ Carbon footprint calculation (individual/department level) ➤ Tree plantation and climate awareness drive
Unit-V	➤ Mock COP session ➤ Policy analysis and presentation ➤ Preparation of sustainability action plan for the campus

General Suggestions:

- Educational visit to Xavier Solai be organized as a common activity for all students.
- Include activity based and project based assignments.
- Conduct orientation programs for EVS faculty on IKS and skill based pedagogy.
- Students examine environmental problems in their local communities and develop solutions to address them.

Reference Books:

1. Singh, J.S., Singh, S.P., Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications.
2. Harris, Frances (2012). Global Environmental Issues, 2nd Edition. Wiley- Blackwell.
3. Krishnamurthy, K.V. (2003). Textbook of Biodiversity, Science Publishers, Plymouth, UK.
4. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).
5. Pittock, Barrie (2009). Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
6. Ministry of Environment, Forest and Climate Change (2019). A Handbook on International Environment Conventions & Programmes.
7. KanchiKohli, Manju Menon (2021). Development of Environment Laws in India, Cambridge University Press.

HUMAN RIGHTS AND SOCIAL ANALYSIS
(26UVEH51)

SEMESTER:IV	VE	HOURS:2	CREDITS:2	TOTAL HOURS:30
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Course Outcomes:

Upon completion of the course, the students will be able to

CO1: Recall key concepts of rule of law, democracy, equality, human dignity, citizenship, social justice, secularism and human rights.(K1)

CO2: Explain the Preamble to the Constitution of India, Fundamental Rights, Directive Principles, civil and political rights, socio-economic and cultural rights and collective rights.(K2)

CO3: Apply constitutional principles and human rights concepts to contemporary social issues. (K3)

CO4: Analyze interrelationships among inequalities, social structures, social problems, and reform initiatives in India. (K4)

CO5: Evaluate the effectiveness of constitutional provisions in promoting equality and social justice.(K5)

CO6: Design strategies fostering equality, communal harmony, responsible democratic citizenship and civic participation. (K6)

Unit I: Understanding basic concepts (6 Hours)

Understanding of key concepts, their meaning and significance in today's context – Rule of law, democracy, equality, human dignity, citizenship, social justice, secularism, human rights, fundamental rights and constitutional values.

Unit II: Classification of Human Rights (6 Hours)

Civil and Political rights, socio-economic and cultural rights collective rights or group rights – Preamble to the Constitution of India, Fundamental Rights - Equality rights, personal freedom and right to life, rights against arbitrary arrest and illegal detention, Rights against exploitation, Religion Freedom, Minority rights and Fundamental Duties (Art. 51A)

Unit III: Indian Social System (6 Hours)

Social Analysis - Social system and its components, Inequalities, caste structures and manifestation, Patriarchy and violence against women, Gender and sexual Minorities– A land of cultural linguistic and religious diversity –secular ethos – religious -fundamentalism-Indian politics -Interdependence of human being and society

Unit IV: Social Problems (6 Hours)

Indian Economic inequality and Poverty - Caste Discrimination : Untouchability, honour killing - Reservation policy, and Dalit empowerment - illiteracy and its effects Child labour, child abuse, bonded labour and their effects

Unit V: Social Reformers (6 Hours)

Promoting social justice and equality, women's rights, and eradication of caste discrimination - Dr. B. R. Ambedkar, Mahatma Gandhi, Dr. Muthulakshmi Reddy, Savitribai Phule, Fathima Sheik, Pandita Ramabai and E. V. Ramasamy - Focusing on service to the marginalized, healthcare, education, and human values

Reference Books:

1. P.N. Sharma, "Social problems and issues in India", Bharat Book Centre, 2014, New India
2. The Reality Reloaded, Gurjot S. Kaler, Chandigarh, India, 2018
3. Course Material Prepared by the Department of Human Excellence
4. Activity-based learning will be conducted in collaboration with the Democracy Forum and Electoral Literacy Club to promote democratic values, constitutional awareness, and responsible citizenship.

INORGANIC CHEMISTRY- I
(Subject code: 26UCHC11)

Semester: I	Core: T1	Credits: 5	Hours/5
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Course Outcomes:

On successful completion of the course, the students will be able to

- CO1: Recall atomic models, spectral interpretation and fundamental principles of quantum theories (K1)
- CO2: Predict elemental classification and chemical behaviour across the periodic table, periodicity, periodic properties and electron affinity (K2).
- CO3: Apply electronegativity, ionization energy, to predict properties of compounds and calculate equivalent and concentration units (K3)
- CO4: Analyze the relationships between atoms and ions in s-block elements (K4).
- CO5: Evaluate the suitability of different titrimetric methods for predicting chemical behaviour and interpreting experimental results(K5)
- CO6: Construct Born–Haber cycle and develop three-dimensional representations of crystal structures (K6)

UNIT I Atomic structure(15Hrs)

History of atom (IKS), J.J. Thomson, Rutherford Moseley's Experiment and Atomic number. Atomic Spectra: Black-Body Radiation and Planck's quantum theory - Bohr's model of atom, Franck-Hertz Experiment. * Interpretation of H-spectrum, *Photoelectric effect, * Compton effect. *Dual nature of Matter - De-Broglie wavelength*-Davisson and Germer experiment*, Heisenberg's Uncertainty Principle - Quantum Numbers. Electronic configuration of atoms and ions* - Numerical problems involving the core concepts. *

Self-Study: Hund's rule, Pauli's exclusion principle and Aufbau principle;

Unit II Periodic Table and periodic properties (15 Hrs)

Modern Periodic Table, Cause of periodicity and recurrence of properties. * Division of elements into s,p,d and f-blocks - Periodic trends* for atomic size- Atomic, Ionic and Covalent radii and effective nuclear charge. * Ionization energy* – successive ionization enthalpy and factors affecting ionization energy* - Electron affinity – Factors influencing and trends of electron gain enthalpy. Electronegativity* - electronegativity scales-Mullikan's scale, Allred Rochow's scale. Applications of electronegativity. Group electronegativity - Factors influencing electronegativity

Self-Study: Pauling's scale of electronegativity and van der Waals radius.

UNIT-III s -Block Elements (15 Hrs)

Anomalous behaviour of lithium - Extraction of lithium from spodumene ore* - Role of Na⁺ and K⁺ ions in biological systems (IKS). Anomalous behaviour of beryllium* (IKS) - Extraction of beryllium*(IKS) - Cause of diagonal relationship – diagonal relationship between lithium and

magnesium - Complexes of Be and Mg - Role of Mg^{2+} and Ca^{2+} ions in biological systems* (IKS). Alkali metal ion batteries* – applications*. Flame tests* – Alkali and alkaline earth metals. Comparative study of group I A elements. Comparative study of group II A elements*

Self-study: Uses of alkali and alkaline earth metals and wrap around complexes ‘of alkali metals

UNIT-IV Chemical bonding – I

(15Hrs)

Ionic bond - Formation with examples - Properties of ionic compounds - Factors influencing the formation of ionic compounds. Lattice energy – Born – Lande equation (derivation not required) and Born-Haber cycle. Ionic crystal structure of NaCl, CsCl, Zinc Blende and TiO_2 *. Covalent bond - Lewis’s concept* - Orbital overlap – concept of covalency – s-s, s-p and p-p overlapping with examples- σ and π bonds – formation of N_2 and O_2 molecules - Characteristics of covalent compounds. Coordinate covalent (or) dative bond - Formation with examples - Characteristics of coordinate covalent compounds – Polar and non-polar molecules - Covalent character in ionic bond - Fajan’s rules -Polarisability and polarization of ions.

Self-Study: Hydrogen bonding and intermolecular forces (IKS).

UNIT-V: Theoretical basis of titrimetric and redox process

(15 Hrs)

Equivalent weight of acids, bases, salts, oxidizing and reducing agents. Different concentration units – molarity, molality, mole fraction, normality and percentage concentrations. Standard solutions - primary and secondary standards. Law of normalities – calculation of strengths of solutions and amount of solute in solutions. *Theory of permanganimetry, dichrometry, iodometry, iodimetry and *complexometric (EDTA) titrations. Redox processes: Electronic concept of oxidation and reduction - Oxidation number rules - Calculation of oxidation number of elements in neutral molecules and in ions - Oxidation and reduction in terms of oxidation number - *Oxidizing agent and reducing agent* - Advantages and disadvantages of oxidizing number concept* - Balancing ionic equations - Ion-electron method - Oxidation number method

Self-study: Common accidents and precautionary measures in chemistry laboratory (IKS). Precautions to avoid errors in titrimetric analysis

* Skill based content
IKS-Indian Knowledge System

Activity based learning

- 1) Photoelectric effect and hydrogen spectrum simulation
- 2) Flame test experiment
- 3) Hard water test
- 4) Identify food items rich in Na, K, Mg, and Ca and discuss their physiological roles.
- 5) Molecular model construction for simple molecules

- 6) Crystal structure models
- 7) Preparation of standard solution
- 8) Balancing redox equations

Textbooks

1. Madan, R.D., and Prakash, S., Modern Inorganic Chemistry, 2nd Edition, S. Chand & Company Pvt. Ltd., New Delhi, 2014.
2. Madan, R.D., Modern Inorganic Chemistry, Revised Edition, S. Chand Publishing, New Delhi, 2019.
3. Puri, B.R., Sharma, L.R., and Kalia, K.C., Principles of Inorganic Chemistry, Milestone Publishers & Distributors, New Delhi, 2021.
4. Lee, J.D., Concise Inorganic Chemistry, 5th Edition, Wiley India Pvt. Ltd., New Delhi, 2008.
5. Cotton, F.A., Wilkinson, G., Basic Inorganic Chemistry, 3rd Edition, John Wiley & Sons, 1987.

Reference Books

1. Housecroft, C.E., and Sharpe, A.G., Inorganic Chemistry, 6th Edition, Pearson, 2024.
2. Cotton, F.A., Wilkinson, G., Murillo, C.A., and Bochmann, M., Advanced Inorganic Chemistry, 6th Edition, John Wiley & Sons, 1999.
3. Miessler, G.L., Fischer, P.J., and Tarr, D.A., Inorganic Chemistry, 5th Edition, Pearson, 2014.
4. Huheey, J.E., Keiter, E.A., Keiter, R.L., and Medhi, O.K., Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edition, Pearson Education India, 2006.
5. Shriver, D.F., Weller, M.T., Overton, T.L., Rourke, J.P., and Armstrong, F.A., Shriver and Atkins' Inorganic Chemistry, 6th Edition, Oxford University Press, 2014.

PRACTICAL: INORGANIC VOLUMETRIC ANALYSIS-I (MICRO LEVEL)

(Subject code: 26UCHP11)

Semester: I	Core: P1	Credits: 3	Hours/W-3	Hours/W - 3
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Course outcomes:

On successful completion of the course, the students will be able to

- CO1:** Recall laboratory safety concepts, common hazards, fire extinguisher types, chemical waste protocols, and devices used in titrimetric estimations (K1)
- CO2:** Grasp and understand the basic principles involved in titrimetric analysis (K2)
- CO3:** Calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution (K4)
- CO4:** Apply safety and titrimetric protocols appropriately and perform titrations such as permanganometry, dichrometry, iodometry, argentimetry, and EDTA complexometry (K3).
- CO5:** Analyze experimental titration data (equivalence point, solution concentration) and identify sources of error. (K4)
- CO6:** Evaluate the reliability of quantitative results of titrimetric analysis through comparison with expected stoichiometric outcomes (K5).

ESTIMATION OF

1. Oxalic acid using analar Oxalic acid (Link KMnO_4)
2. Mohr salt using analar Mohr salt (Link KMnO_4)
3. Ferrous sulphate using analar Mohr salt (Link KMnO_4)
4. Calcium by direct method
5. Lead by indirect method (back titration)
6. MnO_2 and available O_2 in pyrolusite
7. Mohr salt using analar Mohr salt (link $\text{K}_2\text{Cr}_2\text{O}_7$)
8. Ferrous sulphate using analar Mohr salt (Link $\text{K}_2\text{Cr}_2\text{O}_7$)
9. Potassium dichromate using analar potassium dichromate (Link Fe^{2+})
10. Ferrous iron using analar potassium dichromate
11. Potassium permanganate using analar potassium dichromate (Link Fe^{2+})
12. Oxalic acid (from tomato) using standard oxalic acid solution and potassium permanganate link solution.

Reference Books

1. Venkateswaran, V., Veeraswamy, R., and Kulandivelu, A.R., Basic Principles of Practical Chemistry, 2nd Edition, Sultan Chand & Sons, New Delhi, 1997.
2. Nad, A.K., Mahapatra, B., and Ghoshal, A., An Advanced Course in Practical Chemistry, 3rd Edition, New Central Book Agency, Kolkata, 2007.
3. Mendham, J., Denney, R.C., Barnes, J.D., Thomas, M., and Sivasankar, B., Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education Ltd., New Delhi, 2000.

ALLIED I: MATHEMATICS – I

(Course Code:26UMAE11)

Semester - I

EC - T1

Hours/W - 6

Credits - 5

Course outcomes: By the end of the course, the students will be able to:

- CO1** Define fundamental concepts of series, algebraic equations, matrices, and statistics. **(K1)**
- CO2** Explain the nature of roots of algebraic equations and the relationships between roots and coefficients. **(K2)**
- CO3** Apply series expansions and matrix techniques to solve standard mathematical problems. **(K3)**
- CO4** Analyze algebraic equations and matrices to determine roots, rank, and eigenvalues. **(K4)**
- CO5** Evaluate correlation, rank correlation, and regression measures for given data sets. **(K5)**
- CO6** Formulate and solve real-world problems using series, algebra, matrices, and statistical methods. **(K6)**

UNIT I: (15 hours)

Binomial Series – Exponential Series – Logarithmic series.

(Text book 1: Chapter 1)

UNIT II: (15 hours)

Formation of equations - Relation between roots and coefficients -Transformation of equations.

(Text book 2: Chapter 1: Sections 1.1, 1.2, 1.4)

UNIT III: (15 hours)

Rank of a matrix - Cayley Hamilton theorem - Eigen values and Eigen vectors.

(Text book 2: Chapter 2: Sections 2.1, 2.3, 2.4)

UNIT IV: (15 hours)

Hyperbolic functions – Inverse hyperbolic functions - Logarithm of a complex number.

(Text book 1: Chapter 2, Chapter 3)

UNIT V: (15 hours)

Correlation – Rank Correlation – Regression.

(Text book 3: Chapter 1)

Activities:

1. Series approximation activity using standard series to estimate physical quantities such as energy, decay, and small-angle measurements.
2. Matrix and eigenvalue application workshop for solving coupled equations and studying normal modes in mechanical and electrical systems.
3. Experimental data analysis project using correlation and regression to interpret physics laboratory data.

Text books:

1. S. Arumugam and A. Thangapandi Issac, Summation of series and Trigonometry, New Gamma Publishing House, 2003.

2. S. Arumugam and A. Thangapandi Issac, Allied Mathematics paper I, New Gamma Publishing House, 2016.
3. S. Arumugam and A. Thangapandi Issac, Allied Mathematics paper IV, New Gamma Publishing House, 2004.

Reference book:

1. S. Narayanan, R. Hanumantha Rao, T.K. Maicavachagom Pillai and P. Kandaswamy, Ancillary Mathematics Volume I, Ananda Book Depot (SV Printers and Publishers Pvt. Ltd.), 2009.

Website and e-Learning Sources:

1. https://www.scribd.com/document/801016710/Allied-i-Allied-Mathematics?utm_source=chatgpt.com
2. https://www.youtube.com/playlist?list=PLxaL_Pkhcom8VjWs1uXw9c72SqX2QnGWy
3. https://www.scribd.com/document/806501117/Lesson-5-1-Astronomy-in-Ancient-India-1-1-1?utm_source=chatgpt.com
4. https://www.scribd.com/document/978522201/iks-q-a-notes?utm_source=chatgpt.com

ROLE OF CHEMISTRY IN DAILY LIFE (NME)

Semester: I	SEC: 1	Credits: 2	Hours/W - 2
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(Subject code: 26UCHN11)

(Practical Course- for other
major students)

Course outcomes:

On successful completion of the course, the students will be able to

CO 1: Define and list the chemicals used in everyday life and identify the major causes and types (K1)

CO 2: Explain the composition, properties, and applications of polymeric materials (K2)

CO 3: Demonstrate the preparation and functions of cosmetics including toothpaste, face powder, soaps, and detergents (K3)

CO 4: Analyse the composition, preparation, and uses of fertilizers (K4)

CO 5: Evaluate the properties, preparation, and therapeutic importance of pharmaceutical drugs (K5)

CO6: Design environmentally friendly chemical products or formulations related to household chemicals, fertilizers, fuels, cosmetics, pharmaceuticals, pigments, or dyes (K6)

Experiments:

1. Determination of pH of Different Water Samples
2. Qualitative Tests for Food Components (Carbohydrates (Molisch test) Proteins (Biuret test) Fats (Sudan III test)
- 3) Detection of Nitrogen, Phosphorus, and Potassium in Fertilizers
- 4) Flame Test of Different Fuels
- 5) Extraction of Natural Dyes from Plants (Turmeric, hibiscus, beetroot)
- 6) Preparation of Simple Face Powder (Talc + zinc oxide + perfume)
- 7) Determination of Vitamin C in fruit Juice (Lemon) (Iodometric titration.)
- 8) Identification of Paracetamol or Aspirin (Qualitative Test-Ferric chloride test for aspirin)
- 9) Preparation of Soap (Demonstration only)
- 10) Determination of Detergent Foaming Capacity (Comparison of soaps and detergents)
- 11) Preparation of Plaster of Paris (Demonstration only)
- 12) Qualitative Test for Carbon Dioxide in Air – Lime water test
- 13) Determination of pH of soaps and detergents by titrimetric analysis
- 14) Estimation of citric acid in lemon
- 15) Estimation of acid equivalence in commercially available antacids.
- 16) Determination of melting point of waxes and saturated oils.
- 17) Preparation and stabilization of emulsions.
- 18) Determination of gold number of stabilizing agents.
- 19) Identification of hard water
- 20) Acidity and basicity test for Lemon juice, vinegar, soap solution and baking soda solution (Litmus paper test)
- 21) Chlorine test in water (Potassium iodide + starch paper)

Textbooks

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012.
3. S. Vaithyanathan, Textbook of Ancillary Chemistry; Priya Publications, Karur, 2006.

4. B. K. Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
5. Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019.
6. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co. Publishers, second edition, 2006.

Reference Books

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

ORGANIC CHEMISTRY- I
(Subject code:26UCHC21)

Semester: II	Core: T2	Credits :5	Hours/W - 5
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Course outcomes:

On successful completion of the course, the students will be able to

CO 1 : Identify the stereochemical behaviour of molecules (K1)

CO 2 : Explain the fundamental naming of organic compounds (K2)

CO 3 : Determine the 3D structures organic molecules (K3)

CO 4 : Classify the aliphatic systems with reference to organic compounds (K4)

CO 5 : Evaluate the substituent effect in the aromatic reaction systems (K5)

CO 6 : Modify the importance and the uses of Organometallic compounds in the field of organic synthesis (K6)

Unit I: Electronic concept of organic compounds

(15 hrs)

Homolytic and heterolytic cleavages, Types of reagents: electrophiles, nucleophiles and free radicals. Reaction intermediates: carbocation, carbanion, carbenes, benzyne and nitrenes. Electronic effects: Inductive effect - reactivity of alkyl halides, acidity of halo acids, *basicity of amines; inductive and electromeric effects. Resonance – resonance energy, conditions for resonance - *acidity of phenols, *basicity of aromatic amines, steric inhibition to resonance. Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, *dipole moment of aldehydes and nitromethane. Hybridisation: sp, sp² and sp³ with reference methane, ethylene and acetylene.

Self-study: Polar and non-polar covalent bond, Steric effect, field effect

Unit II: Aliphatic Compounds

(15 hrs)

Alkenes - General methods of preparation by dehydrogenation, dehydrohalogenation, dehydration, Hoffmann and Saytzeff rules, cis and trans eliminations - Mechanism of addition reactions to alkenes - Markownikoff's rule - Peroxide effect - hydroboration and ozonolysis - Classification and stability - isolated, cumulated and conjugated dienes - Conjugated diene - 1,2- and 1,4 - addition reaction - Diels - Alder reaction – Alkynes- Reductions using Lindlar's catalyst and Na/liq.NH₃ and hydrolysis - Internal and terminal alkynes - Acidic nature of alkanes, alkenes and alkynes - a comparison.

Self-study: Polymerization - addition polymerization, Ziegler Natta catalysed polymerization

UNITIII: Alicyclic Compounds and Conformation

(15hrs)

Alicyclic compounds - General methods of preparation – Freund's method, Dieckmann condensation, Thrope - Ziegler and Simmon - Smith reactions - *Baeyer's strain theory and its modification - Conformation -Rotomers-potential energy diagram - Staggered and eclipsed

conformations - Conformational analysis of ethane and n- butane - comparison of the population in gauche form in n - butane and ethylene glycol - *Conformations of cyclohexane - chair and boat forms - potential energy diagram -monosubstituted cyclohexanes

Self-study: Fused ring structures – Prismane, Cubane, adamantane, decalin

UNIT IV Aromatic Compounds and Organometallic Compounds

(15 hrs)

Aromatic hydrocarbons - Aromaticity - concept and condition - Huckel rule - benzene, naphthalene, Pyrrole(IKS), pyridine, cyclopentadienyl anion, cyclopropenylcation and tropylium cation - Structure of benzene - Orientation (electronic concept) and* reactivity in monosubstituted benzene - Mechanism of aromatic electrophilic and aromatic nucleophilic substitution reactions. Introduction to Organo metallic compounds - *Grignard reagent – Preparation - Reactions and synthetic application - Organo lithium compounds – Preparation and reactions

Self-study: Organo copper compounds

Unit V Stereochemistry of organic compounds

(15 hrs)

Optical isomerism - Asymmetric carbon atom - Asymmetric, dissymmetric, chiral and achiral molecules - Optical activity - cause of optical activity - optical isomerism exhibited by tartaric acid (erythro, threo, meso and dl forms) - Molecular chirality - biphenyls, allenes and spiranes - Walden inversion - racemization – resolution - asymmetric synthesis - Stereospecific and stereoselective - examples. Concept of entatiomerism and diastereoisomerism - Determination of configuration of organic compounds - *R and *S notation - Geometrical isomerism - Geometrical isomerism in compounds containing carbon - carbon double bond and carbon - nitrogen double bond - Designation of geometrical isomers- cis and trans, syn and anti & E and Z notations

Self-study: Le Bel - van't Hoff theory, Symmetry elements

Activity based learning

1. Hands-on construction of stereochemical models.
2. Polarimeter demonstration (or virtual simulation) to observe optical activity.
3. Digital visualization of three-dimensional molecular structures.
4. Collaborative stereochemistry problem-solving exercises.
5. Case-based discussions linking stereochemistry to pharmaceuticals, agrochemicals, and biomolecules
6. Synthesis and sorting D and L isomer of tartaric acids

TEXTBOOKS

1.M.K. Jain & S.C. Sharma, Modern Organic chemistry, 3rd edition, 2009, Vishal Publishing Co.

2.B.S. Bahl and Arun Bahl, Advanced Organic Chemistry, Reprint-2010, S. Chand & company Ltd.

REFERENCES:

1. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn& Bacon Ltd., (1976).
2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997). [Textbook]
3. Pine S.H, Organic Chemistry, (4th edition) New Delhi, McGraw- Hill, International Book Company. (1986).
4. Mehta, B. and Mehta. M, Organic chemistry, PHI learning Pvt. Ltd., New Delhi (2012).
5. Andrew F Parson, Key Notes in Organic Chemistry, Blackwell Science Publishers, (2003)

CORE-INORGANIC VOLUMETRIC ANALYSIS -II (MICRO LEVEL)

(Subject code: 26UCHP21)

Semester: II	Core: P2	Credit: 3	Hours/W - 3
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Course Outcomes

On successful completion of the course, the students will be able to

- CO 1:** Ability to recall basic concepts of titration and types of standard solutions (K1)
CO 2: Grasp the principles and methodologies in cerimetry and dichrometry (K2)
CO 3: Apply redox titrations to estimate Ferrous Ammonium Sulphate, sodium nitrite, and copper salts (K3)
CO 4: Analyse water hardness and metal ions using acid-base and EDTA titrations (K4)
CO 5: Evaluate titration results and calculate concentrations accurately (K5)
CO 6: Design a proper method to analyze the compounds in real samples (K6)

ESTIMATION OF

1. Ferrous Ammonium Sulphate-FAS (Link Ce^{4+})
2. Sodium Nitrite- NaNO_2 (Cerimetry)
3. Potassium permanganate using analar potassium dichromate (link thio)
4. Potassium dichromate using analar potassium dichromate (link thio)
5. Copper sulphate pentahydrate using analar copper sulphate pentahydrate (link thio)
6. Arseneous oxide using analararseneous oxide (link I_2 solution)
7. Available chlorine in bleaching powder
8. Amount of copper in brass
9. Temporary and permanent hardness of water sample (acidimetry - alkalimetry)
10. Mg^{2+} using analar $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ or $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ (link EDTA)
11. Zn^{2+} using analar $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ (link EDTA)
12. Total and permanent hardness of water sample (EDTA method)
13. Mg and Ba in a mixture (Ba removed as BaSO_4)
14. Amount of calcium in milk powder

Reference:

1. J. Mendhem, R.C. Denney, D. Barnes, M. J. k. Thomas, Vogel's Textbook of Quantitative chemical Analysis, 6th edition, 2002, Pearson Education Ltd.

NOTE: Laboratory manual will be supplied

ALLIED II: MATHEMATICS – II

(Course Code: 26UMAE21)

Semester - II

EC- T2

Hours/W - 6

Credits – 5

Course Outcomes: By the end of the course the students will be able to

- CO1** Define group structures and recall ODEs and PDEs and integrals (K1)
- CO2** Explain Solutions for ODEs and PDE formation method, reduction formula derivations, integrals and Lagrange's theorem (K2)
- CO3** Apply coset computations, solve linear ODEs, first-order PDEs, evaluate definite integrals by parts and compute double/triple integrals (K3)
- CO4** Analyze ODE characteristic roots, PDE standard solutions, integral reduction formula and multivariable transformations order of an element (K4)
- CO5** Evaluate problems combining group orders, ODE systems, PDE solutions, definite integral evaluations, and multiple integral setups (K5)
- CO6** Evaluate ODE methods, PDE and volume/area calculations via integrals (K5)

UNIT I: (15 hours)

Linear equations with constant coefficients - Methods of finding complementary functions - Methods of finding particular integrals - Homogeneous linear equations.

(Text book 1: Chapter 6 (Sections 1- 4))

UNIT II: (15 hours)

Formation of partial differential equations - First order partial differential equations - Some standard forms.

(Text book 1: Chapter 7)

UNIT III: (15 hours)

Definite integrals - Integration by parts - Reduction formulae for $\sin^n x$, $\cos^n x$, and $\tan^n x$ only.

(Text book 2: Part II: Chapter 2(Sections 2.6 - 2.8))

UNIT IV: (15 hours)

Evaluation of Double integrals - Triple integrals - Jacobians - Change of variables in double and triple integrals.

(Text book 2: Part I: Chapter 3(Section 3.9), Part II: Chapter 3(Section 3.2 - 3.4))

UNIT V: (15 hours)

Groups - Subgroups - Cyclic groups - Order of an element - Cosets and Lagrange's theorem.

(Text book 3: Chapter 3(Sections 3.1, 3.5 - 3.8) Statements Only(No Proof))

Text books:

1. S. Arumugam and Issac, Allied Mathematics paper II, New Gamma Publishing House, 2007 (For Unit I and II).
2. S. Arumugam and Issac, Calculus, New Gamma Publishing House, 2011(For Unit III and IV).
3. S. Arumugam and Issac, Allied Mathematics paper I, New Gamma Publishing House, 2004 (For Unit V).

E- Resources:

1. NPTEL (IITs) – Video lectures and problem-solving sessions in Mathematics, <https://nptel.ac.in>
2. Khan Academy – Conceptual clarity with worked examples
<https://www.khanacademy.org>
3. MIT Open Course Ware (OCW) – Advanced explanations and lecture notes
<https://ocw.mit.edu>
4. Paul's Online Math Notes – Step-by-step solved examples, <https://tutorial.math.lamar.edu>

FOOD CHEMISTRY (NME)
(Practical course for other major students)
(Subject code: 26UCHN21)

Semester: II	SEC: 2	Credits: 2	Hours/W: 2
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COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO 1: Ability to define food adulteration and list common food adulterants, pesticide contaminants, and toxicants along with relevant legal regulations for food safety (K1)

CO 2: Explain the causes, types, symptoms, diagnosis, and treatment of food allergies and describe the role of food as allergens (K2)

CO 3: Apply analytical methods to identify food adulterants and demonstrate testing procedures for detecting contaminants in food samples(K3)

CO 4: Analyse the functions, classifications, safety concerns, and legal regulations of food additives, including natural and artificial colours and flavour components (K4)

CO 5: Evaluate the principles, methods, and effectiveness of food processing and preservation techniques in preventing spoilage and ensuring food safety (K5)

CO 6: Design procedures for the analysis and quality assessment of edible oils by determining iodine value, saponification value, and RM value (K6)

Experiments:

1. Detection of Added Water
2. Detection of Metanil yellow and chalk powder in turmeric
3. Detection of argemone oil in mustard oil
4. Detection of artificial colour in Tea Leaves
5. Detection of water, starch, formalin, glucose, urea, soap and detergent in Milk
6. Detection of Artificial Sweeteners in Food Samples
7. Detection of Pesticide Residues (Demonstration)
8. Detection of Lactose in Milk (Benedict's test)
9. Detection of Saccharin in Food Samples
- 10 Estimation of Iodine Value of Oil
- 11 Estimation of Saponification Value
- 12 Determination of Acid Value of Oil (Rancidity measurement)
13. Detection of artificial colour and brick powder in chilli powder
14. Detection of adulteration in coffee
15. Detection of adulteration in honey
16. Detection of vanaspati in butter

TEXTBOOKS

1. Alex V Ramani, Food Chemistry, MJP publishers
2. H. K. Chopra & P. S. Panesar, Food Chemistry, Narosa Publishing House
3. B. Srilakshmi, Dietetics, New age international (P) Ltd. Publishers
4. Swaminathan M., Food Science and Experimental methods, Ganesh and Company.
5. S. A. Joshi, Nutrition and dietetics, tata McGraw-Hill publishing companies

CORE- INORGANIC CHEMISTRY – II
(Subject code: 26UCHC31)

Semester: III	Core: T3 Credits: 5	Hours/W: 5
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Course outcomes

On successful completion of the course, the students will be able to

CO 1 : Ability to define the basics of nuclear reactions and their applications in different fields (K1)

CO 2 : Interpret the concept of acids, bases and zero group elements (K2)

CO 3 : Analyse the structure, bonding and properties of p block elements (K4)

CO 4 : Compare the chemistry of compounds of sulphur, nitrogen and phosphorous (K5)

CO 5 : Evaluate and identify the two acid and basic radicals in the mixture (K5)

CO 6 : Design and formulate procedures to identify unknown ions in the salt by integrating solubility product, common ion effect, pH control, and reaction types. (K6)

UNIT I p – Block Elements

(15 hrs)

General characteristics with reference to configuration, oxidation state, electropositive character and inert pair effect - Hydrides of boron - classification - Types of bonding in boranes. Diborane, carboranes and metallaboranes - preparation, bonding and structure - Wades rule - Structure and bonding in B_4H_{10} , B_5H_9 , B_5H_{11} and $[B_{12}H_{12}]^{2-}$. Boron – tri halides as Lewis’s acids – Relative strengths - Compounds of boron and nitrogen – boron nitride and borazine – preparation, structure and properties. *Carbon - Graphite and diamond – structure and properties. Silicon – Silica (IKS) – different forms and structure - Silicates – different types of silicates - Silicones – preparations, properties and uses – Carborandum (IKS) - preparation, structure and uses. Noble gases - *Position in the periodic table - Isolation, separation and uses. preparations of xenon compounds

Self-study: Zeolites as molecular sieves

UNIT II Nitrogen, Phosphorous, Sulphur and Halogen compounds

(15 hrs)

Nitrogen - Active nitrogen-preparation and properties - Theories of active nitrogen - *Structure, bonding and properties of hydrazine, hydrazoic acid and hydroxylamine - Conversion of NH_3 into HNO_3 (IKS) by Ostwald’s process - *Action of nitric acid on metals and non- metals - Phosphorus - Structure of oxides and oxyacids of phosphorous – Structure of oxides of oxyacids of phosphorus - Sulphur - Structure of S_8 , SO_2 , SO_3 and peracids of sulphur - Preparation and structure of di, tri and tetrathionic acids - Structure of sulphurous acid - Halides of sulphur- SCl_2 & S_2Cl_2 – Halogens-- Interhalogen compounds – types and structure - Basic iodine – Pseudo halogens – Preparation and reactions of cyanogens.

Self-study: Types of phosphazines, preparation of Caro’s acid and Marshall’s acid

UNIT III Theories of acids and bases

(15 hrs)

Concept of acids and bases (IKS) - Arrhenius concept - Bronsted-Lowry concept – conjugate acids and bases - The Lux-Flood concept - Lewis concept - Hard and soft acids and bases (HSAB) – Pearson concept - HSAB principle and its applications - Effect of solvents and

substituents on relative strengths of acids and bases – Super acids and superbases - Classification of solvents and chemical reactions in liquid NH_3 as a non-aqueous solvent - Effect of charge, electronegativity, hydration energy and oxidation state on the strength of acids and bases.

Self-study: Generalized acid-base concept for cations and anions

UNIT IV Nuclear Chemistry (15 hrs)

Radioactive series - Isotopes, isobars, isotones, and K-electron Capture. Natural radioactivity (IKS): Radioactive emanations - characteristics of α , β and γ rays - Detection and measurement of radioactivity – Geiger Muller counter and Wilson cloud Chamber - Radioactive disintegration and half-life period - Average life period - Radioactive equilibrium - Soddy's group displacement law - Mass defect and binding energy–stability of nuclei– *numerical calculations. Types of nuclear reactions - Capture, particle-particle, fission, fusion, and spallation reactions. Nuclear fission and atom bomb. Nuclear fusion and hydrogen bomb- Breeder reactor - Stellar energy - Induced radioactivity. Nuclear reactors - Components of a nuclear reactor. Applications of radioactive isotopes as tracers in the fields of medicine, agriculture, industry and study of reaction mechanisms.

Self-study: Radiation protection and waste disposal

UNIT V *Inorganic Qualitative Analysis (15 hrs)

Salts –reactions of ions- Types of reactions (Addition, decomposition, dissociation, displacement, double decomposition, hydrolysis, redox reactions) - Complex formation reactions- Separation of Cu & Cd in a mixture and Ni&Co in a mixture - Dry heating test- evolution of gases, sublimation, colour change, precipitation and swelling - Charcoal cavity(IKS) reduction and cobalt nitrate tests - Analysis of anions: Tests (with equations) - Dilute H_2SO_4 , conc. H_2SO_4 , $KMnO_4$, HCl - Na_2CO_3 extract test for certain combination of anions (CO_3^{2-} , SO_4^{2-} , SO_3^{2-} , CO_3^{2-} , $C_2O_4^{2-}$ and F^-)-nature of interference - Elimination of interfering anions and preparation of original solutions (with equations) - Analysis of cations- Solubility product concept and common ion effect concept, pH and buffer - Group reagents and separation of analytical groups (with equations)

Self-study: Spot tests for each of Pb^{2+} , Cu^{2+} , Cd^{2+} , Bi^{2+} , Sb^{2+} , Fe^{2+} , Fe^{3+} , Al^{3+} , Co^{2+} , Ni^{2+} , Mn^{2+} , Zn^{2+} , Ba^{2+} , Ca^{2+} , Sr^{2+} , Mg^{2+} ions

Activity Based Learning

1. Classifying different kinds of acids and bases on basis Lewis, Bronsted and Pearson acid-base concept
2. Ranking and sorting of corrosive/ reactive acidic-basic substances
3. Compare structures and properties through molecular model activities
4. Predict the product of reaction using metals and non-metals
5. Identify silicate minerals or rocks and classify their structures
6. Construct 3D ball-and-stick models to understand multicentre bonding
7. Group discussion on nuclear reaction that powers sun and other stars.
8. Solve numerical problems dealing in radioactive decay
9. Case study of nuclear reactors that is operational in India and its significance
10. Detection of cations using flame and other qualitative tests

REFERENCES

1. B.R. Puri and L.R. Sharma, Principles of Inorganic chemistry, 33rd Revised Edn, 2016, Vishal Publishing Co.
2. J. D. Lee, Concise Inorganic Chemistry, 5th edition, 1996, Blackwell Science Ltd.
3. J. E. Huheey, Inorganic chemistry, Principle of structure and reactivity, 4th Edn , 1996, Pearson Education.
4. D.E. Shriver, P.W. Atkins, Inorganic chemistry, 5th Edn, 2010, Oxford Univ. Press.
5. A.G. Sharpe, Inorganic chemistry, 3rd Edn, 1992, Longman Group Ltd.
6. Albert Cotton, Wilkinson, Basic Inorganic Chemistry, 3rd Edn, 2007, John Wiley Pvt. Ltd.
7. G.L. Miessler and D.A. Tarr, Inorganic chemistry, 3rd Edn, 2004, Pearson Education.
8. Alan G. Sharpe, Inorganic chemistry, 2nd Edition, 2005, Pearson Education Ltd
9. R.D. Madan, Principles of Inorganic chemistry, Revised Edn, 2011, S. Chand & Co Ltd.
- 10 H. J. Arinikar Essentials of Nuclear Chemistry, 4th edition New Age International, New Delhi, 1995.
11. A. I. Vogel, Textbook of Qualitative Inorganic Analysis, 1978, ELBS.

CORE-INORGANIC QUALITATIVE ANALYSIS - I (MICRO LEVEL)
(Subject code: 26UCHP31)

Semester: III	Core: P3	Credit :3	Hours/W: 3
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Course outcomes

On successful completion of the course, the students will be able to

- CO 1:** Recall the classical qualitative analysis methods for the detection of acid and basic radicals (K1)
- CO 2:** Illustrate the techniques for the elimination of interfering radicals (K2)
- CO 3:** Classify the metal ions into different groups using appropriate qualitative analysis (K3)
- CO 4:** Analyze the presence of inorganic salts in real samples (K4)
- CO 5:** Evaluate the ion separation using the common ion effect and solubility product (K5)
- CO 6:** Develop a micro-scale qualitative analysis procedure ensuring accuracy, safety, and reduced chemical waste (K6)

Micro level qualitative analysis of simple salt containing one anion and one cation.

Anions: Carbonate, Sulphate, Halides, Nitrate, Borate, Chromate, Fluoride, Oxalate, Tartrate, and Phosphate.

Cations: Lead, Bismuth, Copper, Cadmium, Antimony, Iron, Zinc, Cobalt, Nickel, Manganese, Calcium, Strontium, Barium, & Ammonium.

Qualitative examination of chlorine and fluorine in biological sample (Demonstration only)

References:

1. A. I. Vogel, Textbook of Qualitative Inorganic Analysis, 1978, ELBS.
2. V. V. Ramanujam, Inorganic semi micro-Qualitative analysis, 3rd edition, 1974, The National Publishing Company.

Note: Laboratory manual will be supplied

ALLIED PHYSICS – I
(COURSE CODE: 26 UPHE 31)

SEMESTER - III

EC – T3

HOURS/W– 4 CREDITS – 3

TOTAL HOURS: 60

OBJECTIVES:

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

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

CO1 : know, various modulus involved in the materials,

CO2 : study the flow of liquids due to viscous forces and the transmission of heat
due to process of conduction, convection and radiation.

CO3 : study the various laws involved in heat transformation.

CO4 : classify the various thermodynamic laws and the concept of Entropy.

CO5 : understand the phenomenon like interference and diffraction.

CO6 : study the optical activity of liquids and its uses.

UNIT - I : Elasticity

(12 Hours)

Elasticity - Bending of beams - Expression for bending moment - Uniform bending - Theory - Twisting couple on a cylindrical wire - Expression for a couple per unit twist - Work done - Torsional pendulum - Experiment to determine rigidity modulus of the wire using torsional pendulum - Acceleration due to gravity - Compound pendulum - Theory and experiment.

UNIT - II: Surface Tension

(12 Hours)

Surface tension - Excess of pressure over curved surface - Drop weight method - Coefficient of viscosity and its dimension - Stokes formula for viscous drag - Experiment to determine the coefficient of a highly viscous liquid - Flow of a liquid through a uniform capillary tube - Method of dimensions - Poiseuilles method.

UNIT - III: Specific Heat Capacity

(12 Hours)

Specific heat capacity - Calendar and Barnes continuous flow method - Variation of specific heat capacity of solids with temperature - Variation of atomic heat of solids with temperature - Theory of specific heat - Einstein theory - Debye's theory.

UNIT- 4: Thermal Conductivity

(12 Hours)

Lees disc experiment to determine the thermal conductivity of a bad conductor (cardboard only) - Analogy between heat flow and electric current - Weidemann - Franz law - Newtons law of cooling - Experimental verification - Experiment to determine the specific heat capacity of a liquid - Concept of pressure, volume and temperature of a gas - Mean free path - Expression for mean free path, viscosity,

thermal conductivity.

UNIT - 5: Conventional Energy

(12 Hours)

Conventional energy sources - coal, oil and natural gas - Energy released in a nuclear fission and fusion - Nuclear reactor - Non conventional energy sources - Wind energy - Tidal energy - Wave energy - Photo voltaic effect - Solar cell - Solar ponds.

TEXTBOOKS

1. A. Ubald Raj & G. Jose Robin - Properties of Matter and Optics, Indira Publications, 1st Edition.
2. A. Ubald Raj & G. Jose Robin - Allied physics, vol.2 (Thermal Physics and Sound) Indira Publications, 1st Edition.

REFERENCE BOOKS

1. N. Sundararajan, George Thomas, Syed Azeez - College Physics
Vol 1, United Publishers, 1st Edition.
2. A. Ubald Raj & G. Jose Robin - Oscillations, Properties of Matter and Energy Physics and Optics and Spectroscopy - Indira Publications, 1st Edition.
3. Brijlal - Heat and Thermodynamics and Statistical Physics, S. Chand & Company – 2010.
4. R. Murugesan - Properties of Matter S. Chand and Company – 2010.

ALLIED PHYSICS - I (PRACTICAL)
(COURSE CODE: 26 UPHE 32)

SEMESTER - III EC – P1 HOURS - 2 CREDITS - 2 TOTAL HOURS: 30

Experiments

1. Young's modulus - Uniform bending - Telescope
2. Young's modulus - non-uniform bending - Pin & Microscope
3. Coefficient of Viscosity - Constant pressure head method
4. Surface Tension - Drop weight method
5. Acceleration due to gravity - Compound pendulum
6. Conductivity of bad conductor - Lee's disc method
7. Newton's law of cooling - verification
8. Specific heat capacity of a liquid - Newton's law of cooling
9. Torsional Pendulum - Determination of rigidity modulus

MATERIALS SCIENCE
(For chemistry major students only)
Subject Code: 26UCHS31

Semester: III	SEC: 5	Credits: 2	Hours/W - 2
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Course outcomes

On successful completion of the course, the students will be able to

- CO1 : Define the fundamental concepts of classical free electron theory, Fermi energy and band theory (K1)
- CO2 :Explain the superconducting behaviour and magnetism in molecular and atomic level (K2)
- CO3 :Apply the concepts of semiconductor materials and quantum dots to illustrate their advantages and technological applications (K3)
- CO4 :Analyze the mechanisms, properties, and classifications of superconducting and magnetic materials(K4)
- CO5 :Evaluate the principles, materials, and performance of energy harvesting and generating systems (K5)
- CO6 :Design advanced energy storage solutions by integrating knowledge of rechargeable batteries, supercapacitors, hydrogen storage materials, and fuel cells (K6)

Unit I INTRODUCTION TO MATERIALS

(6 hrs)

Classical free electron theory – Fermi energy - Band theory - Zone theory - *Differences – conductors, semiconductors and insulators. Concept of hole

Unit II SEMICONDUCTING MATERIALS

(6 hrs)

Intrinsic and extrinsic semiconductors - P-N junction. *Working principle of LED and QLED. Forward and reverse biasing of P-N junction diodes. Variation of Fermi level with temperature and distribution of atoms. Semiconductor quantum dots- advantages and applications.

Unit III SUPERCONDUCTING AND MAGNETIC MATERIALS

(6 hrs)

Mechanism and properties of superconductors. Types and applications of superconductors. Magnetism. Para, Dia, ferro & antiferromagnetic materials (IKS). Molecular magnetism - hysteresis. Applications of magnetic materials

Unit IV ENERGY HARVESTING/GENERATING MATERIALS

(6 hrs)

Photovoltaic effect- principle of solar energy (IKS) conversion into electricity. Dye (IKS) sensitized solar cells. Thin film polymer and Si material for solar energy. Hydrogen production methods. Fuel cells. Elementary ideas about materials used in fuel cell

Unit V ENERGY STORAGE MATERIALS

(6 hrs)

Rechargeable batteries. Materials used – applications - Li-ion battery - Lithium-air and Li-S batteries - Ni-MH battery - *Differences between fuel cells – storage batteries. Super-capacitor materials - Similarities and differences between batteries and supercapacitors. Hydrogen storage materials (IKS)

TEXTBOOKS:

1. Dr. M. Arumugam, Material Sciences, Anuradha Publications.
2. P.K. Palanisamy, Material Sciences, SciTech Publications.
3. Ryan P.O Hayre, Suk-Won Cha and Whitney Colella, Fuel cell fundamentals, John Wiley & Sons (2006)
4. B. Viswanathan, Nano Materials, Narosa Publications (2009) Fuel cells, Bruce E Logan

CORE – ORGANIC CHEMISTRY – II (THEORY)
(Subject code: 26UCHC41)

Semester: IV	Core: T4	Credits: 4	Hours/W - 4
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Course outcomes

On successful completion of the course, the students will be able to

CO1: Explain the nucleophilic and electrophilic mechanistic approach in aliphatic halogen compounds (K2)

CO 2: **Apply** the physical and chemical properties of aryl halogen compounds in synthetic use. (K3)

CO 3: **Infer** the chemical reactivity hydroxyl and carbonyl compounds in industrial and synthetic part (K3)

CO 4: Outline usage of synthetically important aryl halogen compounds in synthetic chemistry. (K4)

CO 5: Design new reactions with reference to the available naming reactions. (K6)

CO 6 : Decide the importance of various synthetically active compounds for making new compounds (K5)

UNIT I Halogen Compounds

(12 hrs)

Aliphatic halogen compounds -General methods of preparation and reactions of monohalogen compounds- Mechanisms of S_N^1 , S_N^2 , S_N^i , E_1 , E_2 and E_{1cB} reactions - Aromatic halogen compounds - General methods of preparation and reactions of aryl halides- Preparation and reactions of benzyl chloride - Nuclear and side chain halogen compounds – distinction - Preparation, structures and uses of DDT and BHC -Unsaturated halogen compounds – reactions of vinyl chloride and allyl chloride- Comparison of the reactivity of the above halides

Self-study: Impact of Fluorocarbons on environment, comparison between aryl and alkyl halides

UNIT II Alcohols and their derivatives

(12 hrs)

*Aliphatic alcohols - Classification – 1° , 2° and 3° alcohols, mono, di- and trihydric alcohols - Reactions of monohydric alcohols - Acidic nature and hydrogen bonding in alcohols(IKS)-Phenols - Classification-mono, di, and trihydric phenols and examples - General methods of preparation and reactions of monohydric phenols - Influence of nature and position of substituents on acidity of phenols- Thio alcohols - General methods of preparation and reactions - Comparison of acidic nature of alcohols(IKS), thio alcohols and phenols

Self-study: *Reactions of analytical importance of phenols

UNIT III Carbonyl Compounds

(12 hrs)

Aliphatic aldehydes and ketones - Relative reactivity of their carbonyl groups - General reactions of aldehydes and ketones - General mechanism of addition and condensation reactions - Aromatic aldehydes and ketones (IKS)- General methods of preparation, reactions and tests - Mechanisms of

aldol condensation, benzoin condensation, Cannizzaro reaction, Claisen –Schmidt condensation, Knoevenagel reaction, Perkin reaction and iodoform reaction

Self-study: Comparative properties of aliphatic and aromatic aldehydes

Unit IV Carboxylic Acids and Their Derivatives

(12 hrs)

Aliphatic monocarboxylic acids - Acidic nature and factors influencing the acid strength of carboxylic acids - Aliphatic dicarboxylic acids - Action of heat – Blanc's rule - Action of heat on hydroxy and amino acids, and saturated dicarboxylic acids, Addition to maleic and fumaric acids - Conversion into carboxylic derivatives – acid chloride, amide, ester, anhydride, Hunsdiecker reaction and Hell Volhard Zelinsky reaction - Ascent and descent of fatty acids - Trans esterification - Arndt - Eistert synthesis, Aromatic mono carboxylic acids(IKS) - General methods of preparations - Acidity – effect of substituents in the benzene ring

Self-study: Aromatic dicarboxylic acids, Tests for carboxylic acids

Unit V Synthetically important esters and their derivatives

(12 hrs)

Preparation, synthetic *applications and structure of acetoacetic ester - *Preparation and synthetic applications of malonic ester- aromatic esters. *Preparation and reactions of benzene sulphonic acid- Preparations and uses of saccharin and chloramine-T

Self-study: Tautomerism – keto – enol, Nitro and aci-nitro form, amide –imide, imine – enamine preliminary ideas

Activity based Learning

1. Case study on their synthesis, applications, environmental impact, and regulations
2. Identify 1°, 2°, and 3° alcohols using Lucas test
3. Demonstrate differences in boiling points and solubility using simple laboratory experiments
4. Compare acidity using pKa data and reaction-based activities
5. Perform qualitative tests (Tollens', Fehling's, Schiff's, 2,4-DNP, iodoform)
6. Compare acidity using substituted acids and pKa values
7. Investigate industrial applications of Saccharin and Chloramine-T

TEXTBOOK: M.K. Jain & S.C. Sharma, Modern Organic chemistry, 3rd edition, 2009, Vishal Publishing Co.

REFERENCES:

1. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn& Bacon Ltd., (1976).
2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).
3. Pine S.H, Organic Chemistry, (4th edition) New Delhi, McGraw- Hill, International Book Company. (1986).
4. Mehta, B. and Mehta. M, Organic chemistry, PHI learning Pvt. Ltd., New Delhi (2012).

CORE - INORGANIC QUALITATIVE ANALYSIS-II (Micro Level)

Subject code: 26UCHP41

Semester: IV	Core :P4	Credit : 3	Hours/W – 3
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Course outcomes

On successful completion of the course, the students will be able to

CO1: Recall the systematic procedure for qualitative analysis of a salt mixture (K1)

CO2: Illustrate the identification of acid radicals through confirmatory group tests and observations (K2)

CO3: Classify the metal ions into different groups using systematic qualitative analysis (K3)

CO4: Analyze the presence of inorganic salts in real samples using appropriate analytical methods. (K4)

CO5: Evaluate complex mixtures using analytical reasoning to justify the separation and identification of multiple ions. (K5)

CO6: Design and implement micro-analytical procedures ensuring minimal reagent use and sustainable laboratory practices. (K6)

Micro level qualitative analysis of mixture of salts containing **two anions** and **two cations**.

Anions: Carbonate, sulphate, halides, nitrate, borate, chromate, fluoride, oxalate, tartrate, and phosphate.

Cations: Lead, bismuth, copper(IKS)r, cadmium, antimony, iron, zinc, cobalt, nickel, manganese, calcium, strontium, barium, & ammonium.

Qualitative examination of Iron, calcium and Magnesium in biological sample (Demonstration only)

References:

1. Vogel A. I., Textbook of Qualitative Inorganic Analysis, 1978, ELBS.
2. V. V. Ramanujam, Inorganic semi micro-Qualitative analysis, 3rd edition, 1974, National Publishing Company.

Note : Laboratory manual will be supplied

ALLIED PHYSICS – II
(COURSE CODE: 26 UPHE 41)

SEMESTER - IV EC - T4 HOURS - 3 CREDITS - 3 TOTAL HOURS: 45

COURSE OUTCOMES At the end of the course, the student will be able to

CO1: make the learner understand the basic principles of electricity.

CO2: understand the applications of optics in everyday life.

CO3: inculcate the knowledge in electronics circuits.

CO4: learn the basic concepts of relativity.

CO 5: understand the principles amplifiers and oscillators.

UNIT - I

(9 Hours)

Coulomb's law – electric field – electric field due to a point charge – electric dipole (IKS) – electric flux – Gauss law – applications – electric field due to a charged conducting sphere (point inside and outside) – uniformly charged cylinder (line charge) – electric potential – potential difference – relation connecting electric field and electric potential at a point – equipotential surface.

UNIT - II

(9 Hours)

Self-induction of a coil – calculation of self-inductance of a long solenoid – alternating current – phase difference between current and voltage in alternating circuits with resistance only, capacitance only and inductance only – LR circuit – LCR series resonance circuit – LCR parallel resonance circuit(characteristics only).

UNIT - III

(9 Hours)

Junction diode – biasing – pn diode equation – V-I characteristics – Zener diode – experiments – applications –Zener diode – Junction transistor – voltage-divider biasing – transistor amplifier – CE configuration – feedback principle - Barkhausen criterion for oscillations.

UNIT - IV

(9 Hours)

Interference – air wedge – Newton's rings – diffraction – experiment to determine the wavelength of monochromatic light using plane transmission grating - polarization – double refraction.

UNIT - V

(9 Hours)

Frame of reference – Galilean transformation – special theory of relativity – Lorentz transformation equation – velocity transformation equations - relativistic velocity addition – length contraction – time dilation – variation of mass with velocity – Einstein's mass energy relation.

TEXT BOOK

1. A. Ubalal Raj and G. Jose Robin – Allied Physics Vol.I – Indra Publication 1st Edition.

REFERENCE BOOKS

1. N. Sundararajan, George Thomas and Syed Azeez – College Physics Vol. II, United Publishers, 1st Edition 2009.

2. N. Sundararajan, George Thomas and Syed Azeez – College Physics Vol. III, United Publishers, 1st Edition 2009.

3. A. Ubalal Raj and G. Jose Robin – Relativity, Wave Mechanics and Nuclear Physics, Indra Publication 1st Edition 2009.

4. N. Subramanyam, Brijlal and M. N. Avadhanulu – A text book of optics – S. Chand & Company Ltd., 23rd Edition 2006.

ALLIED PHYSICS – II (PRACTICALS)
(COURSE CODE: 26 UPHE 42)

SEMESTER – IV EC– P2HOURS – 2 CREDITS – 2 TOTAL HOURS: 30

Experiments

1. Grating - Oblique Incidence
2. Air wedge - Thickness of Wire
3. LCR Series Resonance
4. LCR Parallel Resonance
5. Newton's Rings
6. Zener Diode Characteristics
7. Diode Rectifier
8. Spectrometer Grating Normal Incidence Method
9. Spectrometer - Prism - Determination of refractive index of glass
10. Focal length of convex lenses in contact and out of contact

ELECTIVE- THERMODYNAMICS AND SOLID STATE

(Subject code: 26UCHE43)

Semester: IV

Core: EC-T5

Credits: 4

Hours/W – 4

Course outcomes

On successful completion of the course, the students will be able to

CO1: Identify the principles of heat movement in any natural process (K1)

CO2: Examine the structure of unknown solid crystals and suggest their regularity (K3)

CO3: Classify and explain the principles of thermodynamics (K4)

CO4: Explain spontaneity and non-spontaneity of processes (K2)

CO5: Analyze a given solid crystal using X-ray diffraction data (K5)

CO6: Design new solid crystals with desired physical and chemical properties (K6)

Unit I Thermodynamics – I

12hrs

Introduction – various forms of energy – scope of equilibrium thermodynamics - Thermodynamic systems, surroundings and walls(IKS) - Thermodynamic properties – extensive and intensive properties - Thermodynamic state – state variables or functions -Thermodynamic processes -Zeroth law and concept of temperature - Thermodynamic work (w) – general expression for w – free expansion – expansion against constant pressure – reversible expansion- Thermodynamic heat (q) – w and q as path functions – exact and inexact differentials - First law of thermodynamics (i) as law of conservation of energy (ii) in terms of change in internal energy (ΔU) – U as a state function – w in reversible and irreversible evaporation and condensation - Heat capacity – C_p and C_v of gases – variation with temperature – molar heat capacities – relation between C_p and C_v for ideal gas (IKS) – C_p and C_v as state functions - Enthalpy (H) – ΔH in physical and chemical processes – Bomb calorimetry – calculation of ΔH using Hess law – bond energy – variation of ΔH with temperature (Kirchoff equation)

Self study: energy work equivalence – theories of heat exchange – modes of heat transfer

Unit II Thermodynamics – II

12hrs

Application of First law to an ideal gas - Calculation of w, q and ΔU in isothermal and adiabatic processes -Joule – Thomson (J.T) effect – μ_J T of ideal gases and real gases – inversion temperature for van der Waals gases and its significance - Second law - Conversion of heat into work – Clapeyron’s restatement of Carnot’s ideas for ideal gases – thermodynamic efficiency – Carnot theorem – thermodynamic scale of temperature - Spontaneous processes – need for II law – Kelvin-Planck statement and Clausius statement of II law - Concept of entropy (S) – S as state function – “isolated system” – Clausius inequality for systems other than “isolated system” - S and spontaneity - *Calculation of ΔS for ideal gases and for physical changes - *S as a measure of (i) randomness (ii) probability.

Self study: heat of physical changes – latent heat – absolute zero

Unit III Thermodynamics – III

12hrs

Conditions for material equilibrium - At constant T and P – Gibbs energy (G) – G as state function - At constant T and V – Helmholtz energy (A) – A as state function - Change in A and G - A as a maximum work for a reversible isothermal process - G as non-PV work for reversible isothermal process at constant P – relation between A and G - A and G as criteria for spontaneity - Variation of G with P at constant T for a pure substance in one phase – evaluation of G for ideal gases - Concept of fugacity, activity and activity coefficient with respect to gases - Variation of G with T at constant P – Gibbs-Helmholtz equation and its application - Clapeyron equation, Clausius – Clapeyron equation and applications - G in chemical changes - Reaction isotherm – thermodynamic equilibrium constant and its significance.- Standard Gibbs energy change – prediction of reaction yield and reaction feasibility - van't Hoff equation for gas phase reactions- An elementary idea of partial molar quantities (IKS) and chemical potential - Third law – Nernst heat theorem leading to III law – III law entropies – calculation of S of chemical reactions.

Self study: comparison of chemical changes and physical changes – reactions in gas phase-liquid phase

Unit IV Solid state – I

12hrs

Characteristics of solids(IKS) - Crystals, crystallography, unit cell, space lattice - Crystal forms and crystal lattices - First law of crystallography (Steno's law) - Lengths and axes required to define unit cell -Seven crystal systems and their conventional cell axes and angles - *Cube – Simple cubic, f.c.c and b.c.c lattices- Naming of crystal planes – law of rationality of indices (Huay's law) – Weiss coefficients and procedure for finding Miller indices - Spacing between lattice planes from X-ray diffraction -Diffraction pattern - Two approaches of viewing the origin of observed diffraction pattern – Laue equations & illustration using primitive cubic unit cell – Bragg equation - Total scattering intensity related to the periodic structure of electron density in the crystal -Experimental methods – Powder method – Rotating crystal method - *Internal structure analysis of NaCl and KCl crystals - Determination of Avogadro number from crystal studies.

Self study: light spectrum – slits – grating – diffraction patterns

Unit V Solid state – II

12hrs

Binding energy of ionic crystals - Cohesive energy and lattice energy - Theoretical calculations of the lattice energy – The Born – Mayer potential, Madelung energy and Madelung constant – The Born Lande (BL) equation - The Born Haber (BH) cycle – BH cycle for NaCl and calculation of the lattice energy. The structure of metals(IKS): *The closest packing spheres (CCP, HCP, BCC). Heat capacity of solids. Imperfections in solids – Stoichiometric (Schottky

and Frenkel defects) and non-stoichiometric (metal excess and metal deficiency) defects. *Line and plane defects.

Self study: packing fraction and packing efficiency

Activity based learning

1. Understanding the principle and working of Thermos flask and Refrigerator
2. Construction of bomb calorimeter and approximate calculation for heat capacity of selected organic compounds
3. Rationalizing the feasibility and developing methods for the feasibility of reaction
4. Investigation of role of temperature in determination of the velocity of non-equilibrium and equilibrium reactions
5. Investigation of different kinds of packing defects and suggesting efficient packing methods of solids

TEXTBOOKS

1. J. Brockington, Peter Stamper and David Browning, Physical chemistry for higher education, Longmann, 1985
2. Peter Atkins and Julio de Paula, Atkin's Physical Chemistry, Oxford University Press.
3. K. J. Laidler and J.H. Meiser, Physical Chemistry, CBS.
4. CNR Rao, University general chemistry, Macmillan, 1986 print
5. S.H. Maron and C.F. Prutton, Principles of Physical Chemistry, Oxford & IBH Publishing Co. Pvt. Ltd.
6. Puri, Sharma and Pathania, Principles of Physical Chemistry, 2001, Shobanlal Nagin & Co., Vishal.

ENVIRONMENTAL STUDIES

(26UEVS41)

SEMESTER: IV	EVS	HOURS:2	CREDITS:2	TOTAL HOURS:30
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Course Outcomes:

The students will be able to:

- CO1:** Describe various natural resources and the fundamental principles of sustainable development to explain resource interdependence. (K1)
- CO2:** Explain the relationship between biodiversity and various conservation approaches to maintain ecological balance. (K2)
- CO3:** Apply prevention and mitigation strategies to address specific environmental issues and ecosystem degradation. (K3)
- CO4:** Illustrate the adverse health impacts of different types of pollution on human populations and ecosystems. (K3)
- CO5:** Evaluate environmental quality indicators and the effectiveness of climate change mitigation risks. (K5)
- CO6:** Summarize major international environmental treaties and national legislations aimed at environmental protection. (K2)

Unit I: Natural Resources

(6 Hours)

Environment (IKS) – Definition; Overview of natural resources: definition, types of natural resources. Biotic and abiotic, renewable and non-renewable resources. Water resources: types, over-exploitation, issues, challenges, water scarcity, conflicts. Soil and mineral resources (IKS): important minerals, problems, soil as a resource. *Energy resources: sources, conventional and non-conventional, implications. (IKS-Traditional water conservation methods (e.g., temple tanks, ooranis, johads). Indigenous agricultural practices and soil conservation methods.)

Unit II: Environmental pollution and Health

(6 Hours)

Natural and man-made disasters and their impacts of environment and management. Pollution: definitions, natural and man-made pollution. Different types of pollution (IKS)- Air, Water, Soil, Noise, Radioactive and solid waste pollution: Sources of pollution, different types of pollutants, effects of pollution in environment and human health, prevention and control of pollution. (IKS-Traditional waste management practices. Herbal and indigenous methods to reduce pollution impacts.)

Unit III-Conservation of Biodiversity and Ecosystems

(6 Hours)

Biodiversity and its distribution (IKS): Levels and types, India and world, hotspots, threat categories. *Ecosystems and ecosystem services: major types in India, basic characteristics, significance.

Threats to biodiversity and ecosystems: land use, commercial exploitation of species and invasive species (IKS). Types of Biodiversity conservation (*In-situ and Ex-situ*). (IKS-Sacred groves and community-based conservation practices, Role of indigenous communities in biodiversity protection)

Unit IV: Climate change: Impacts, Adaptation and Mitigation (6 Hours)

Climate change: structure and different layers of atmosphere, Impacts, vulnerability and adaptation to climate change. Mitigation of climate change: GHGs types, sources, impacts and control. Importance of 1.5⁰C and 2.0⁰C Global warming and Ozone depletion. Concept of carbon intensity (IKS), energy intensity and carbon neutrality; policy instruments, carbon capture and storage, climate justice. Anthropogenic factors - Human over population, over consumption, pollution, Mining, Transport, Environmental degradation and Impact of human activities. (IKS- Traditional climate-resilient farming practices. Indigenous housing designs for climate adaptation.)

Unit V: Environmental Treaties, Legislation and Sustainable Development (6 Hours)

Overview of instruments of international cooperation: bilateral, multilateral, conventions and protocols, COPs. Major International Environmental Agreements: CBD, CITES, UNCCD, UNFCCC. Major Indian Environmental *Legislations: acts, rules, sites, areas, zones and judgments. Introduction to sustainable development: SDGs, targets and indicators, challenges and strategies. *Principle of sustainable development, international efforts of sustainable development and sustainable development in India: Perspective and strategies. (IKS-Community based natural resource management models.)

Skill-Based Activities:

Unit-I	➤ Field observation of local water bodies ➤ Preparation of a household resource audit report ➤ Case study analysis on sustainable practices
Unit-II	➤ Air and water quality observation survey ➤ Preparation of eco-friendly products (natural cleaners, composting) ➤ Awareness campaign design
Unit-III	➤ Biodiversity documentation of campus/local area ➤ Preparation of herbarium or digital biodiversity register
Unit-IV	➤ Carbon footprint calculation (individual/department level)

	➤ Tree plantation and climate awareness drive
Unit-V	➤ Mock COP session ➤ Policy analysis and presentation ➤ Preparation of sustainability action plan for the campus

General Suggestions:

- Educational visit to Xavier Solai be organized as a common activity for all students.
- Include activity based and project-based assignments.
- Conduct orientation programs for EVS faculty on IKS and skill-based pedagogy.
- Students examine environmental problems in their local communities and develop solutions to address them.

Reference Books:

1. Singh, J.S., Singh, S.P., Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications.
2. Harris, Frances (2012). Global Environmental Issues, 2nd Edition. Wiley- Blackwell.
3. Krishnamurthy, K.V. (2003). Textbook of Biodiversity, Science Publishers, Plymouth, UK.
4. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).
5. Pittock, Barrie (2009). Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
6. Ministry of Environment, Forest and Climate Change (2019). A Handbook on International Environment Conventions & Programmes.
7. Kanchi Kohli, Manju Menon (2021). Development of Environment Laws in India, Cambridge University Press.

CORE – ORGANIC CHEMISTRY – III (THEORY)
Subject Code: 26UCHC51

Semester : V	Core : T5	Credits : 4	Hours/W - 4
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Course outcomes

On successful completion of the course, the students will be able to

- CO 1:** Tabulate the importance of nitrogen compounds (K1)
CO 2: Explain the preliminary ideas in fused cyclic systems (K2)
CO 3: Illustrate the fundamental concepts of pericyclic reactions (K3)
CO 4: Summarize the importance of redox reagents in organic synthesis (K5)
CO 5: Classify different spectral techniques based on the source they use. (K4)
CO 6: Find and apply suitable techniques for the quantitative and qualitative analysis of chemicals in laboratories and in industries. (K6)

UNIT I Nitrogen Compounds (12 hrs)

Aliphatic nitro compounds -General reactions-acidic nature of α - hydrogen atom, reduction. Aromatic nitro compounds - *General methods of preparation and reactions. Aliphatic amines - Classification – 1°, 2° and 3° amines - General methods of preparation and reactions of loamines. Aromatic amines -General methods of preparation and reactions. *Comparison of basic strength of aliphatic and aromatic amines. *Preparation and reactions of diazomethane. Reactions of benzene diazonium salt.

Self-study: Commercial methods of preparation, structure and *estimation of urea

Unit II Pericyclic Reactions (12 hrs)

Fundamental concepts of concerted reactions. Classification of pericyclic reactions. Woodward-Hoffmann rules. FMO and MO correlation diagram methods to electrocyclic (1,3-butadiene) and cycloaddition reactions (2+2 additions). Sigmatropic rearrangements – Cope rearrangement

Self-study: Electrocyclic and Cycloaddition reactions of $4n+2$ system

Unit III Condensed Systems (12 hrs)

Polynuclear compounds. Binuclear compounds -*Synthesis, reactions and structure of naphthalene -Structural elucidation of naphthalene -Preparations and reactions of naphthols and naphthoquinones. Trinuclear compounds - Reactions of anthracene - *Preparations and reactions of anthraquinone - Preparation and reactions of anthracene. *Comparison of benzene, naphthalene and anthracene based on their resonance energy.

Self-study: Isolation of naphthalene and anthracene from petroleum products

***Unit IV Reagents in organic reactions (12 hrs)**

Periodic acid (HIO_4), Ozone (O_3), Lead Tetra Acetate (LTA), Selenium Dioxide (SeO_2),

Osmium Tetroxide (OsO_4). Aluminium isopropoxide, Dicyclohexylcarbodiimide (DCC), Lithium Aluminium Hydride (LAH), Sodium Borohydride (NaBH_4), Stannous Chloride (SnCl_2), Phase transfer catalyst. N- Bromo Succinimide (NBS),

Self-study: Preparation of above listed reagents

***Unit V - UV – Visible and Infrared Spectroscopy**

(12 hrs)

Ultra violet – visible spectroscopy - Chromophore, auxochrome (IKS), bathochromic shift, hypsochromic shift, hyperchromic effect and hypochromic effect - Various types of electronic transitions and their relative energies – allowed and forbidden transitions with respect to carbonyl group and olefinic bond - Effect of solvent polarity on max - *Woodward- Fieser empirical rules – calculation of λ_{max} for conjugated dienes and unsaturated ketones. *Infrared spectroscopy - Sampling techniques for solids, liquids and gases - Positions of IR absorption frequencies for functional groups like aldehyde, ketone, alcohol, acid and amide - cFactors affecting the frequency of absorption – conjugation (resonance effect), inductive effect and hydrogen bond - Finger print region.

Self-study: Instrumentation of UV–Visible and IR spectroscopy

Activity based Learning

1. Compare basicity using pK_a values and substituent effects
2. Analyze reaction pathways and prepare synthetic flowcharts
3. Interpret UV spectra and calculate λ_{max} using Woodward–Fieser rules and structure elucidation of compounds
4. Design and prediction of feasibility of reactions
5. Mimicking the organic compounds by designing model miniatures.

TEXTBOOKS:

1. M.K. Jain & S.C. Sharma, Modern Organic chemistry, 3rd edition, 2009, Vishal Publishing Co.
2. Depuy C H and Chapmann, Molecular reactions and Photochemistry, Prentice-Hall of India, New Delhi, 1988
3. Ian Fleming, Pericyclic Reactions, Oxford Science Publications, Cambridge, 1999
4. V. K. Ahluwalia, Organic Reaction Mechanisms, 3rd edition, 2007, Narosa Publishing House
5. Y. R. Sharma, Elementary organic spectroscopy, S. Chand & company Ltd.

REFERENCES

1. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn& Bacon Ltd., (1976).
2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997). [Textbook]
3. Pine S.H, Organic Chemistry, (4th edition) New Delhi, McGraw- Hill, International Book Company. (1986).
4. Mehta, B. and Mehta. M, Organic chemistry, PHI learning Pvt. Ltd., New Delhi (2012).

INORGANIC CHEMISTRY – III

Subject code: 26UCHC52

Semester : V Core : T6

Credits : 3

Hours/W – 4

Course outcomes

On successful completion of the course, the students will be able to

CO 1: Define the fundamental concepts of coordination chemistry (K1)

CO 2: Gain the ability to explain VBT and MOT to explain chemical bonding in molecules (K2)

CO 3: Demonstrate the importance of transition and inner transition elements (K3)

CO4: Analyze and explain the applications of nanomaterials and their significance in materials science and technology (K4)

CO 5: Evaluate the principles in supramolecular chemistry (K5)

CO 6: Perform and explain gravimetric analysis techniques, and account for errors in gravimetric method. (K6)

Unit I Chemical Bonding – II

(12 hrs)

Wave mechanical principles involved in the treatment of VBT and MOT - The valence bond theory (VBT) formation of H_2 molecule - *VSEPR theory and geometry of H_2O , NH_3 , CH_4 , BF_3 , PCl_5 , SF_4 , SF_6 , IF_5 , IF_3 , ClF_3 , ICl_4^- Geometry of CO^{2-} , SO^{2-} and NO_3^- . Structures of XeF_2 , XeF_4 , XeF_6 , $XeOF_2$, $XeOF_4$, XeO_3 , and XeO_2F_2 . Molecular orbital theory - Linear combination of atomic orbital method (LCAO) as applied to H_2 molecule - BMO and ABMO - MO diagrams for diatomic homo-nuclear species – H_2 , H^+ , He_2 , He^+ , Li_2 , Be_2 , B_2 , C_2 , N_2 , O_2 , O_2^+ , O_2^- , O_2^{2+} , O_2^{2-} and F_2 Bond order – Prediction of their existence and its correlation with stability (VBT)- MO diagrams for hetero nuclear molecules – CO, NO, CN and HF - MO diagram for BeH_2 and NH_3 . Comparison of VBT and MOT.

Self-study: Octet rule, resonance, formal charge and hybridization

Unit II d and f block Elements

(12 hrs)

Name and electronic configurations (VBT) – first series of transition elements, lanthanides and actinides. Vanadium - Extraction of vanadium and uses - Polyvalency of vanadium. Titanium - Extraction of titanium and uses. Lanthanides - Oxidation state, colour, magnetic properties and stability - Separation of lanthanides (VBT) - Lanthanide contraction – causes and consequences - Uses of lanthanides and their compounds – shift reagents. Actinides – Actinide series - Oxidation state and their relative stabilities - Comparison of lanthanides and actinides. Transuranic elements.

Self-study: The position of lanthanides and actinides in the periodic table. The minerals of lanthanides and actinides and their occurrences in India.

Unit III Coordination Chemistry-I

(12 hrs)

Introduction – molecular or addition compounds (IKS). Double salts and co-ordination compounds – comparison. Coordination compounds-acceptors and donors (ligands), types of ligands. Werner's co-ordination theory-postulates and limitations. Chelation and its application. *Stereochemistry of coordination compounds with respect to coordination number 2 to 6. Nomenclature of co-ordination compounds. Isomerism in co-ordination compounds - Ionization and hydrate isomerism - Coordination isomerism, linkage isomerism and co-ordination position isomerism - Polymerization isomerism - Geometrical and optical isomerism – four and six co-ordination - Sidgwick concept, limitations and EAN rule.

Self-study: Jorgenson's chain theory for coordination complexes

Unit IV Nanoscience and Supramolecular Chemistry

(12 hrs)

Introduction to nanomaterials–Aspect ratio- Dimensions of nanomaterials: 0D, 1D and 2D - Carbon nanostructures–Fullerenes, CNTs and graphene. Synthesis of nanomaterials-sol-gel, solvo/hydro thermal, chemical vapour deposition and electrochemical deposition, Sono chemical and coprecipitation method – Preparation of metal and metal oxide nanoparticles – Ag, Au, ZnO and TiO₂. Characterization technique – SEM and TEM. Properties of nanomaterials- optical, electrical, magnetic, mechanical and electrochemical. Applications of nanomaterials in various fields. Supramolecular chemistry – Definition, various types of non- covalent interactions. Host-guest chemistry (IKS) – Types of guests. Molecular hosts, self-assembly and supramolecular devices

Self-study: Bulk vs nanomaterials, high surface to volume ratio, quantum structures and quantum confinement

Unit V Gravimetric Methods of Analysis

(12 hrs)

Fundamental requirements of precipitation (IKS). Mechanism of precipitation- supersaturation (IKS), nucleation and crystal growth. Factors influencing particle size. Organic and inorganic precipitants - Specific and selective precipitants. *Co-precipitation – surface adsorption and occlusion - Errors due to coprecipitation. Precipitation from homogeneous solution. *Post precipitation. Digestion of the precipitate. Filtration and washing. Drying and weighing. (IKS)

Self-study: Ostwald ripening, common ion effect, super saturation and relative supersaturation.

Activity based Learning

1. Prepare industrial process flowcharts and listing of extraction methods
2. Use model kits to differentiate double salts and coordination compounds
3. Tool kit design of hard water analysis or metal ion complexation

4. Synthesis and observe crystal growth under different supersaturation condition
5. Prepare posters on graphene, fullerenes and Carbon nanotubes and harnessing its application in various fields

References:

1. B.R. Puri and L.R. Sharma, Principles of Inorganic Chemistry, 2006, Milestone Publications.
2. Albert Cotton, Wilkinson, Basic Inorganic Chemistry, 3rdEdn, 2007, John Wiley Pvt. Ltd.
3. J.E. Huheey, Inorganic chemistry, Principle of structure and reactivity. 4thEdn ,1996, Pearson Education.
4. J. D. Lee, Concise Inorganic Chemistry, 5th Edn,1996, Blackwell Pub.Com.
5. D.E. Shriver, P.W. Atkins, Inorganic chemistry, 5th Edn,2010, Oxford Univ. Press.
6. R.D. Madan, Principles of Inorganic chemistry, Revised Edn, 2011, S. Chand& Co Ltd.
7. Vogel A. I., Textbook of Quantitative Inorganic Analysis, ELBS,1978
8. M. A. Shah Tokeer Ahmed, Principles of nanoscience and nanotechnology, 2011, Narosa publications.
9. B. Viswanathan, Nano Materials, 2011, Narosa publications.
10. T. Pradeep, "Nano: The essential", 2007, Mc-Graw-Hill education.
11. J. M. Lehn, Supramolecular Chemistry, Concepts and Perspectives, 1995, VCH; Weinhein.
12. J. W. Steed, J. L. Atwood, Supramolecular Chemistry 2000, John Wiley & Sons Ltd, New York

PHYSICAL CHEMISTRY – I
Subject code: 26UCHC53

Semester: V	Core : T7	Hours:4	Credits : 3
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Course outcomes

On successful completion of the course, the students will be able to

- CO 1:** Describe the distribution of molecular velocities in a gas sample and identify the factors affecting this distribution (K1)
- CO 2:** Explain the principles of colloidal systems and summarize their technological applications (K2)
- CO 3:** Identify and apply the concepts of intermolecular forces to determine the types of forces present in molecules based on their structures. (K3)
- CO 4:** Analyse phase equilibria and construct phase diagrams for single-component and multi-component systems. (K4)
- CO 5:** Evaluate the effect of changes in concentration, volume, and temperature on the equilibrium position using Le Chatelier's principle (K5)
- CO 6:** Formulate phase diagrams for chemical systems by integrating knowledge of phase transformations with temperature and composition (K6)

Unit I: Gaseous State

(12 hrs)

Kinetic molecular gas model (IKS). Assumptions made to describe an ideal gas. Maxwell – Boltzmann distribution of molecular velocities (a qualitative discussion only) – its graphical representation and salient features – effect of temperature – most probable, mean and r.m.s velocities and their calculation – experimental verification of the distribution law. *Kinetic equation for gases ($PV = \frac{2}{3}mnc$). Collision properties – collision diameter, collision frequency, collision number, mean free path (λ). Viscosity of gases – relation between η and λ . Principle of equipartition of energy (IKS) – Average translational kinetic energy per degree of freedom. *Deviation of gases from ideal behaviour – compressibility factor as a function of P - van der Waals equation.

Self-Study: Boyle's law, Charle's law, Avogadro's law, ideal gas equation, Graham's law of diffusion, Dalton's law of partial pressures.

Unit II: Liquid State and Colloidal State

(12 hrs)

Liquid state - Structural differences among solids, liquids and gases - Liquid crystals – Smectic, nematic and cholesteric liquid crystals – swarm theory – applications of liquid crystals. Colloidal state- Distinguishing characteristics of colloids, suspensions and solutions - Types of colloidal dispersions - (i) Optical properties of suspensoids – *Tyndall effect, explanation (IKS) and theory due to Gustau Mie – Determination of diameter by minimum intensity method, transmission method (ii) *Kinetic properties – Brownian motion & Einstein's mathematical consideration – sedimentation and determination of radius. (iii) Electrical properties – Helmholtz and diffuse double layers – electro kinetic or zeta potential – electrophoresis and its applications – stability of suspensoids - Coagulation – methods of coagulation – Hardy Schultz law – Hofmeister series - Protective colloids – protective action – gold number – applications - Emulsions – classification, preparation, identification - Gels – preparation – properties (thixotropy, syneresis and imbibition)

Self-Study: Different states of matter, isotropic and anisotropic properties of solids, dispersed phase, dispersed medium, different colloidal systems with examples (IKS).

Unit III : Molecular properties & Surface Chemistry

(12 hrs)

Molecular forces - Polar and non-polar molecules - dipole moment Dipole – dipole, dipole – induced dipole, induced dipole – induced dipole forces - *Hydrogen bond – conditions for formation – intermolecular and intramolecular hydrogen bonding – effect of hydrogen bonding on melting point, solubility, physical state – unique properties of water. Molecular properties -Electrical properties: electrical polarization of dielectrics and polarisability – Clausius-Mossotti equation – orientation of dipoles in an electric field and Debye equation Dipole moment - *Applications of dipole moment studies - estimation of ionic character, calculation of bond moments, distinguishing geometrical isomers and o-, m-, p- isomers, study of shapes of simple triatomic molecules. Influence of resonance on dipole moment. Surface Chemistry-adsorption on solids-types of adsorption-differences between physisorption and chemisorption - *Adsorption isotherms- Freundlich Adsorption isotherms- Langmuir Adsorption isotherms.

Self-Study: Pure covalent bond, polar molecules, dipole moment, adsorbent, adsorbate with examples.

Unit IV: Phase Equilibria

(12 hrs)

Phase equilibrium -Basic concepts – phase, number of components, degrees of freedom - Gibbs phase rule - Phase diagram and discussion - (i) water system (ii) sulphur system (iii) Pb-Ag system (iv) Sn-Mg system (v) NaCl- H_2O (freezing mixture) (vi) $FeCl_3-H_2O$ (System with congruent melting compounds) (vii) $Na_2SO_4 - H_2O$ (System with incongruently melting hydrates i.e peritectic change) – construction of phase diagram to find eutectic temperature and eutectic composition of naphthalene biphenyl system.

Self-Study: Homogeneous system and heterogeneous system with examples.

Unit V: Chemical Equilibria

(12 hrs)

Chemical equilibrium, Equilibrium constant and need for its knowledge. The thermodynamic equilibrium constant. K_p and K_c for gaseous reactions. Properties of equilibrium constant. Equilibria in gaseous systems and Le Chatelier principle (i) Decomposition of HI, PCl_5 and ammonia (ii) the phosgene equilibrium – relation between formation constant and dissociation constant – effect of inert gas on equilibrium. Equilibrium constant for heterogeneous reactions (i) dissociation of cupric oxide (ii) carbon disulphide equilibrium – Effect of pressure. Variation of K_a , K_p and K_c with temperature.

Self-Study: *Reversible and irreversible reactions, equilibrium, forward and backward reactions, extent of a reaction.

Activity based Learning

1. To predict payload of the gas-balloon on basis of gas laws
2. Demonstration comparing gas diffusion through porous media
3. Harnessing the compressibility of gas in road safety and smooth driving using vehicles
4. electrophoretic separation of amino acids and other biological substances

5. Preparation of colloidal solution in process of dye, ink making
6. Making of Emulsion and its application in surface penetration and solubility enhancement

TEXTBOOKS:

1. P.L Soni and D.P. Dharmarha, Textbook of Physical Chemistry, 1980 ed, Sultan Chand & sons.
2. S.H. Maron and C.F. Prutton, Principles of Physical Chemistry, Oxford & IBH Publishing Co. Pvt. Ltd.
3. Puri, Sharma and Pathania, Principles of Physical chemistry, 2001, Shoban Lal Nagin& Co., Vishal Philip Matthews, Advanced chemistry, Low price ed. 1996, Cambridge University press

Core - PHYSICAL CHEMISTRY – II

Subject code: 26UCHC54

Semester: V	Core: T8	Credits: 3	Hours/W - 4
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Course outcomes

On successful completion of the course, the students will be able to

CO 1: Identify different types of electronic excitations in a molecule (K1)

CO 2: Predict the applications and buffer actions of various solutions (K3)

CO 3: Assign the point group of any molecules (K5)

CO 4: Explain the basic principles of wave mechanics (K2)

CO 5: Calculate the stability of molecules. (K5)

CO 6: Collect, accurately record, interpret and draw conclusions from spectral data. (K6)

Unit I: Biophysical Chemistry of Acids & Bases

(12 hrs)

Strength of acids and bases – Basic strength of solvent – Dielectric constant of the solvent – effect of structure on the strength of acids – meaning of strength of acid – titration does not reflect the strength of an acid. Acid – base equilibria in water – LMA – The ionization of water – The equilibrium constant and ionization constant of water. The concept of pH – place of various materials in the pH scale – pOH. *Ionization of weak acids and weak bases – dissociation constants – pKa & pKb. Hydrolysis of salts (CH_3COONa , NH_4Cl , NaCl). Effect of salts upon the dissociation of acids. Buffers – The Henderson – Hasselbalch equation – buffer capacity – *The good buffers. *Titration curves of weak acids, strong acids and polybasic acids with a strong base. pH dependent function and structure of biomolecules (ionization of amino acids, ionization of proteins, biological activity of proteins). *Biologically important buffers – double layers – various models – Donnan membrane equilibrium.

Self-Study: pH, pH scale, acid base concepts

Unit II: Group Theory

(12 hrs)

* Symmetry and importance of symmetry aspects. Geometry of different types of molecules with and without lone pair of electrons. Symmetry elements and associated symmetry operations. Definitions and examples - Axis of rotation (C_n) – order of C - Plane of reflection (σ) – σ_v , σ_h and σ_d - Centre of inversion (i) - Rotation – reflection axis (S_n) – examples - Identity (E) - Knowledge of polarity and chirality from symmetry elements. Successive C_n , σ and S_n operations. Mathematical group – Characteristics of a group – construction of group multiplication table (GMT) for H_2O and NH_3 – Abelian and non - Abelian groups. Point groups – Schoenflies notations and subscripts – systematic procedure for identification of molecular point groups.

Self-Study: Draw the structure of simple molecules like water, ammonia, carbon di oxide, benzene, boron tri fluoride, Hydrogen peroxide (cis and trans). Xenon tetra fluoride, etc.

Unit III: Quantum Chemistry

(12 hrs)

Dynamic variables- postulates of classical mechanics-conservation laws-coordinate systems-Newtonian equation of motion- Inadequacy of classical physics - Blackbody radiation – Wein's equation – Rayleigh - Jeans equation – Planck's equation - Photoelectric effect – Einstein equation and the quantization of energy, work function, threshold energy – Dual theory of radiation. The foundations of Quantum Mechanics - The wave nature of electrons – Prince de Broglie concept and wavelength - Heisenberg uncertainty principle in different forms - Development of Schrodinger wave mechanics by analogy with wave theory of electromagnetic radiation – equation for a wave traveling in one direction – eigen function or wave function –Hamiltonian time independent Schrodinger equations (Derivations not expected) – Eigen equation - Born interpretation of Ψ – Probability and probability density of electron - Normalization and normalized eigen functions - Q.M. postulates – linear operators, commuting operators, Hermitian operators, orthogonality of wave functions - Q.M. of a simple system – The free particle.

Self-Study: Quantum theory, electromagnetic wave

Unit IV: Spectroscopy-I

(12 hrs)

Electromagnetic radiation- quantization of energies in molecules (translational, rotational, vibrational and electronic). Microwave spectroscopy- condition- theory- selection rule- *effect of isotopic substitution- application - Calculation of μ and bond length of diatomic molecules. UV visible spectroscopy-conditions- theory of electronic spectroscopy - Types of electronic transitions-Frank-condon principle-predissociation - Dissociation energy – *Applications of electronic spectra

Self-Study: Electromagnetic radiations

Unit V: Spectroscopy-II

(12 hrs)

Infrared spectroscopy-condition-molecular vibration-modes of vibration of linear and non-linear molecules - Diatomic- CO_2 , H_2O - stretching and bending vibrations-selection rules - Calculation of force constant-isotope effect - *Applications of IR spectra-group frequencies, finger printing and hydrogen bonding. Raman spectroscopy-condition- Rayleigh and Raman scattering - Stokes and Antistokes –difference between Raman and IR spectroscopy - *Rotational Raman spectra-application to covalent compounds-mutual exclusion.

***Self-Study:** atomic weight, Isotopes, centre of symmetry, conditions to form hydrogen bonding.

Activity based Learning

1. Measurement the pH of common household solutions using pH paper or pH meter
2. Preparation buffer solutions of different pH and evaluate their buffering capacity
3. Making up of the acids and bases to the desired pH and pK_a values and desired volume.
4. Extraction of salts from solution techniques
5. Detection of traces of gases in atmosphere using spectroscopic data

TEXTBOOKS

1. P.L Soni and O.P. Dharmarha, U.N.Dash, Textbook of Physical Chemistry, Sultan Chand & sons, 23rd revised edition 2010 reprint.
2. S.H. Maron and C.F. Prutton, Principles of Physical Chemistry, Oxford & IBH Publishing Co. Pvt. Ltd.
3. Puri, Sharma and Pathania, Principles of Physical chemistry, 2001, Shoban Lal Nagin & Co., Vishal
4. Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath, Biophysical chemistry, Himalaya Publishing House.
5. Philip Matthews, Advanced chemistry, Low price ed. 1996, Cambridge University press.
6. K. J. Laidler and J.H. Meiser, Physical chemistry, First Indian edition, reprint 2006
7. Skoog, Holler and Nieman, Principles of instrumental analysis, 5th edition First reprint 2006. Thomson.
8. C.N. Banwell and E.M. McCash, Fundamentals of molecular spectroscopy, 4th ed. Tata McGraw Hill Publishing 2002 Reprint. Co. Ltd.,

ELECTIVE- BIOMOLECULES

Subject code: 26UCHE51

Semester: V	EC-T6	Credits : 2	Hours/W- 2
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Course outcomes

On successful completion of the course, the students will be able to

- CO 1:** Classify carbohydrates and explain monosaccharide structures, epimerization, mutarotation, and Kiliani/Wohl syntheses (K2)
- CO 2:** Draw disaccharide structures and compare polysaccharides and cellulose derivatives (K3)
- CO 3:** Analyse amino acid zwitterion properties, preparation, tests, and peptide end-group analysis (K3)
- CO 4:** Evaluate the effectiveness of Dragendorff's test versus Hofmann methylation for alkaloid functional group identification and structure confirmation (K5)
- CO 5:** Apply isoprene rule to classify terpenoids and elucidate structures of citral, geraniol, camphor,
- CO 6:** Design synthesis routes combining Kiliani ascent, peptide coupling, and terpenoid assembly for novel natural product analogues (K6)

Unit I Carbohydrates-I

(6 hrs)

Introduction and classification - monosaccharides - Epimers and epimerization, anomers, * reducing and * non-reducing sugars- * Reactions of glucose and fructose- Structures of glucose and fructose – open chain structure, limitations, configuration, mutarotation and ring structure- Inter-conversion of glucose and fructose and vice-versa- Ascending series – *Kiliani synthesis. Descending series – Wohl's synthesis

Self-study: Configuration of Aldotriose and aldopentose

Unit II Carbohydrates-II

(6 hrs)

Disaccharides - Properties, * reactions and structure of sucrose- Structure of maltose and lactose (elucidation not included)- Starch – bonding – amylase – amylopectin – reactions- Structural differences between starch and cellulose- Cellulose derivatives – *preparation and uses of cellulose nitrate and cellulose acetate.

Self-study: Haworth projections of disaccharides.

Unit III Amino Acids

(6 hrs)

Introduction - Amino Acids -Introduction and classification– dipolar ion and iso-electric

point - General methods of preparation and reactions of amino acids – test for amino acids - Peptide – peptide linkage, nomenclature, and polypeptides, End group analysis C - terminal and N - terminal analysis.

***Self-study:** Ninhydrin test mechanism.

Unit IV Alkaloids

(6 hrs)

Alkaloids - Definition, classification, occurrence and extraction - General methods of identification – functional nature of oxygen, functional nature of nitrogen, unsaturation, oxidation and Hofmann exhaustive methylation - Structure and * synthesis of coniine, piperine and nicotine.

Self-study: Dragendorff's reagent test.

Unit V Terpenoids

(6 hrs)

Terpenoids - Introduction, classification and isolation of terpenoids – isoprene rule - Structure and synthesis of citral, geraniol, camphor and menthol

Self-study: Isoprene rule applications.

Activity bases Learning

1. Listing of natural products and their medicinal importance
2. Structural visualization and stereochemical interpretation.
3. Chromatographic and phytochemical techniques.
4. Qualitative analysis of carbohydrates and amino acids.
5. Steam distillation apparatus setting up; Purification using thin-layer chromatography demonstration

TEXTBOOKS

1. M.K. Jain & S.C. Sharma, *Modern Organic Chemistry*, 3rd edition, 2009, Vishal Publishing Co.
2. B.S. Bahl and Arul Bahl, *Advanced Organic Chemistry*, Reprint 2010, S. Chand & Company Ltd.
3. V.K. Ahluwalia & R.K. Parashar, *Organic Chemistry*, 2nd edition, 2012, Viva Books Pvt. Ltd.
4. O.P. Tandon, *Organic Chemistry*, Latest edition, GR Bathla Publications.
5. P.L. Soni, *Advanced Organic Chemistry*, Vol. 2, 2015, Sultan Chand & Sons.
6. I.L. Finar, *Organic Chemistry*, Vol. I & II, 3rd Indian Reprint, 2001, Pearson Education.

Medicinal Chemistry

(Subject code: 26UCHE51)

Semester : V

EC-T6

Credits : 2

Hours/W - 2

Course outcomes

On successful completion of the course, the students will be able to

CO1: Recall the basic concepts of drugs, their sources, classifications, pharmacological principles, and medicinal plants used in healthcare (K1)

CO2: Explain the mechanisms of drug action, drug metabolism pathways, causes of diseases, and therapeutic roles of pharmaceutical compounds and medicinal plants (K2)

CO3 Apply the principles of pharmacology and medicinal chemistry to interpret drug absorption, routes of administration, and treatment approaches for common diseases (K3)

CO4 Analyze the relationship between chemical structure and biological activity of pharmaceutical drugs, including antibiotics, antimalarials, analgesics, and sulpha drugs (K4)

CO5 Evaluate the effectiveness and therapeutic significance of drugs and medicinal plant constituents in the prevention and treatment of diseases (K5)

CO6 Design approaches for utilizing pharmaceutical knowledge and medicinal plant resources to address health-related problems and improve therapeutic outcomes (K6)

Unit -1: Drugs and classifications

(6 hrs)

Introduction- Source of drugs (IKS)-Pharmacodynamics, molecular pharmacology-Pharmacophore, chemotherapy- Classification- chemical classification-Biological classification

Unit-2: Mechanism and metabolism of drugs

(6 hrs)

Mechanism of action-Action at cellular and extracellular site- Drug receptors and biological responses- Mechanism of different types of drug action-Physical and chemical properties of drugs-Chemical pathways of drugs metabolism, absorption of drugs- Route of Administration

Unit-3: Causes and common diseases

(6 hrs)

Infective and hereditary diseases- Insect borne diseases and their treatment- Air born diseases and their treatment-Water borne diseases-other diseases, jaundice, asthma, leprosy-*First aid for accidents

Unit -4: Pharmaceuticals Drugs

(6 hrs)

Sulpha drugs- synthesis of various sulpha drugs, sulphonamides, sulpha pyridine, sulphadiazine. *Antibiotics- classification-Streptomycin, *Chloramphenicol *synthesis-mode of action of antibiotics. Anti-malarial drugs (4-amino quinoline derivatives, chloroquine-synthesis, pharmacological properties, and mode of action.

Antipyretics and analgesics – *aspirin, *paracetamol (synthesis and application), *narcotics – morphine, codeine (structure)-Tranquilizers, hypnotics, anesthetics – procaine.

Unit-5: Medicinal plants

(6 hrs)

Introduction –importance and uses-Hibiscus rosa-sinensis-constituents and properties-Adathodavasisa- *Ocimum sanctum (IKS)--Mangifera indica (IKS)-Azadirachta indica (IKS)--Phyllanthus niruri and solanum trilobatum

Activity based Learning

1. Investigate natural and synthetic drug sources through case studies
2. Identify pharmacophores using simple drug structures
3. Compare routes of drug administration using case scenarios
4. Study drug metabolism pathways using animations
5. Analyze patient case studies to determine suitable dosage forms
6. Conduct a community survey on common diseases and preventive measures
7. Demonstrate basic first aid - bandaging, CPR awareness, bleeding control
8. Prepare reaction schemes for aspirin, paracetamol, chloroquine, and sulpha drugs
9. Prepare a herbarium or digital catalogue of medicinal plants
10. Compare traditional medicinal uses with scientific evidence
11. Extract phytochemicals from medicinal plant

Text books

1. J. Ghosh, A Text book of Pharmaceutical chemistry, S. Chand Publishing,
2. G. R. Chatwal, synthetic drugs, Himalaya publishing house
3. J. Ghosh, Fundamental concepts of applied chemistry, S. Chand Publishing.

**INORGANIC GRAVIMETRIC ESTIMATIONS AND PREPARATION OF
COORDINATION COMPOUNDS (PRACTICAL)**

Subject Code : 26UCHP55

Semester : V	Core :P5	Credit : 3	Hours/W - 4
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Course outcomes

On successful completion of the course, the students will be able to

- CO1:** List the principles, reagents, and procedural steps involved in gravimetric and colorimetric estimations of metal ions and the preparation of coordination compounds (K1)
- CO2:** Explain the theoretical basis of gravimetric analysis, precipitation reactions, colorimetric methods, and complex formation in coordination compounds (K2)
- CO3:** Apply gravimetric and volumetric techniques to estimate metal ions such as barium, lead, calcium, nickel, and copper in given samples and mixtures (K3)
- CO4:** Analyse experimental data to determine the composition, purity, and percentage yield of synthesized coordination compounds and metal ion estimations (K4)
- CO5:** Evaluate the accuracy and reliability of analytical results by considering sources of error, precision, and limitations of gravimetric, volumetric, and colorimetric methods (5)
- CO6:** Synthesize coordination compounds using appropriate experimental procedures and design systematically approaches for qualitative and quantitative inorganic analysis (K6)

Gravimetric Estimation of

1. Barium as barium chromate
2. Barium as barium sulphate (Incineration method)
3. Lead as lead chromate
4. Calcium as calcium oxalate monohydrate
5. Nickel as nickel dimethylglyoxime
6. Copper as copper thiocyanate
7. Nickel by gravimetric and copper by volumetric method (mixture)
8. Copper and iron by colorimetric method

For demonstration only

1. Sulphate as Barium sulphate
2. Iron as oxide

Preparation of

1. Tetramminecopper (II) sulphate
2. Tris(thiourea)copper(I) sulphate
3. Potassium trioxalatochromate(III)
4. Hexamminenickel(II) chloride
5. Hexamminecobalt(III) chloride
6. Hexaaquochromium(III)chloride
7. Tetramminecarbanatocobalt(III)nitrate
8. Sodium trioxalatoferrate (III) hydrate

REFERENCES:

- 1.R. Gopalan, P.S. Subramanian, K. Rangarajan, Elements of Analytical chemistry, Third edition, 2003, Sultan Chand and sons, Educational publishers, New Delhi.
- 2.R. Gopalan, V. Ramalingam, Concise Coordination Chemistry, 2001, Vikas publishing House pvt.Ltd.
3. J. Mendhem, R.C. Denney, D. Barnes, M. J. K. Thomas, Vogel's Text Book of Quantitative Chemical Analysis, 6th edition, 2002, Pearson education Ltd.

Note: Laboratory Manual will be supplied.

***ESTIMATION OF ORGANIC COMPOUNDS & PREPARATION OF ORGANIC
COMPOUNDS (PRACTICAL)
(Subject code: 26UCHP51)**

Semester : V	Core-P6	Credit : 3	Hours/W - 4
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Course outcomes

On successful completion of the course, the students will be able to

- CO1** Recall the principles, reactions, reagents, and safety precautions involved in the estimation of phenol, aniline, amino acids, glucose, and citric acid.
- CO2** Explain the reaction mechanisms and underlying chemical principles of oxidation, hydrolysis, acetylation, benzylation, bromination, nitration, and osazone formation.
- CO3** Perform quantitative estimations of phenol, aniline, and amino acids and carry out single-stage organic preparations using appropriate laboratory techniques.
- CO4** Analyze experimental observations, reaction progress, and analytical data to determine the purity, yield, and characteristics of organic compounds.
- CO5** Evaluate the accuracy, precision, and reliability of estimation methods and synthetic procedures by comparing experimental results with theoretical values.
- CO6** Design and optimize experimental procedures for the preparation, purification, and characterization of organic compounds by integrating appropriate analytical and synthetic techniques.

Estimation of

1. Phenol
2. Aniline
3. Amino Acid

Demonstration experiments

1. Estimation of glucose by Bertrend's method
2. Estimation of citric Acid

Single stage preparations

1. Oxidation of an aldehyde
2. Hydrolysis of (i) an ester and (ii) an amide
3. Acetylation of an amine or a phenol
4. Benzylation of an amine or a phenol
5. Bromination of (i) phenol and (ii) an anilide
6. Nitration of (i) nitrobenzene and (ii) phenol
7. Osazone from glucose

NOTE: Laboratory manual will be supplied

APPLIED CHEMISTRY (PRACTICAL)

(Subject code: 26UCHP52)

Semester : V	EC-P3	Credit : 1	Hours/W - 2
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Course outcomes

On successful completion of the course, the students will be able to

- CO1: Recall** the principles, terminology, instrumentation, reagents, and safety procedures involved in chromatographic, volumetric, electrochemical, thermal, and environmental analyses.
- CO2: Explain** the principles of chromatographic, electrochemical, thermal, and analytical techniques used in chemical investigations.
- CO3: Perform** quantitative and qualitative analyses such as determination of hardness, pH, alkalinity, conductance, calorific value, vitamin C content, metal ion concentration, and soil nutrients.
- CO4: Analyze** experimental data, chromatograms, titration results, electrochemical measurements, and environmental parameters to interpret the quality and composition of samples.
- CO5: Evaluate** the accuracy and reliability of analytical methods and experimental results for quality assessment of environmental, food, industrial, and pharmaceutical samples
- CO6: Develop** testing protocols for the analysis of water, soil, food, fuel, and pharmaceutical samples

Experiments

- 1) Determination of R_f value in thin layer chromatography
2. Determination of hardness of water.
3. Determination of heat of hydration of cement.
4. Determination of setting time of cement.
5. Determination of copper in bronze.
6. Determination of percentage of iron in iron salts.
7. Determination of flash point and fire point of a fuel.
8. Determination of calorific value of a fuel using bomb calorimeter.
9. Detection of food adulterants (milk, turmeric, sugar, etc.)
10. Soil analysis for nitrogen, phosphorus, potassium (NPK)
11. Determination of conductance of electrolyte solutions.
12. Fabrication of simple fuel cell or battery.
13. Preparation of paracetamol or aspirin.
14. Estimation of vitamin C in fruit juices or tablets.
15. Determination of pH, alkalinity, and hardness of water samples.
16. Analysis of fluoride or nitrate in water.
17. Detection of food adulterants using rapid methods
18. Antacid capacity of antacid tablet

INTERNSHIP

SEMESTER V

SUB CODE: 26UCHI51

CREDITS:2

- All UG students will undergo internship during the summer holidays of the second year after completing IV semester.
- Two credits will be given for internship.
- Minimum Days: 21
- Minimum working time per day: 3 Hrs. & Maximum working Time: 5 Hrs.
- The places of internship can be government offices, Panchayats, MP, MLA offices, private institutions, companies, production units etc.
- The HOD of the departments will give a letter of introduction to each student.
- The students will identify the company / institution for internship.
- The students will be divided equally based on the number of professors available in the departments. Each professor will serve as a guide to the assigned students.
- The students will finalize the institutions / companies for the internship in consultation with the guides.
- The students shall maintain a Work Diary which will be countersigned by the managers / authorities of the company in which the students do the internship on a daily basis.
- The Work Diary, Work Completion Certificate obtained from the company and a comprehensive report on the learning outcomes will be submitted to the guides at the end of the internship.
- Viva will be conducted based on the experience of the internship in the month of August. The guide will be the internal examiner and another faculty from the same department will serve as the external examiner.

ORGANIC CHEMISTRY-IV
Subject Code: 26UCHC61

Semester : VI	Core : T9	Credits:4	Hours/W – 4
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Course outcomes

On completion of the course, the students will be able to

CO 1: Explain nomenclature, preparation, and properties of key heterocyclic compounds (K2)

CO 2: Predict migratory aptitude and mechanisms in molecular rearrangements (K3)

CO 3: Illustrate mechanisms of named organic reactions and their applications (K2)

CO 4: Interpret ¹H NMR and mass spectra to elucidate molecular structures (K4)

CO 5: Evaluate photochemical vs thermal reactions and assess green chemistry principle effectiveness (K5)

CO 6: Design solvent-free reactions and sustainable synthetic strategies (K6)

Unit I Heterocyclic Compounds (12 hrs)

Introduction - Nomenclature-Preparation and properties of Furan, Pyrrole, Thiophene, Pyridine, Indole, Quinoline and Isoquinoline

Self-study: Preparation, reactions, and medicinal applications of Imidazole.

Unit II Molecular Rearrangements (12 hrs)

Wolff rearrangement, Pinacol – pinacolone rearrangement, Dienone- phenol rearrangement, Beckmann rearrangement, Lossen rearrangement, Favorskii rearrangement, Stevens rearrangement. Neber rearrangement, Claisen rearrangement, Diene-Phenol rearrangement. Fries rearrangement. Benzidine rearrangement, *Hofmann rearrangement, wagner-Meewein rearrangement

Self-study: Classification of molecular rearrangement reactions

Unit III Reactionsand Mechanisms (12 hrs)

Birch reduction, Kolbe's Schmidt reaction, Bayer-Villiger oxidation, Mannich reaction, *Etard reaction, Dakin reaction, Bouveault – Blanc reaction, Kolbe electrolytic reduction, *knoevenagel reaction, Dieckmann reaction, Curtius reaction, *Michael addition, *chichibabin reaction

Self-study: Isotopic labelling studies

Unit IV NMR Spectroscopy and Mass Spectrometry (12 hrs)

Principle – solvent, Equivalent and non-equivalent protons, Shielded and deshielded protons – anisotropy. Chemical shift and internal reference–TMS-and scales. Peak area and proton counting. Splitting of signals – spin-spin coupling. Factors affecting Chemical shift, Interpretation of ¹H NMR spectra of simple compounds. ¹³C NMR-Introduction and Basic principle. ¹H Mass spectrometry. Principle of mass spectrometry - Fragmentation pattern - m/z values of various fragments - Nitrogen rule - ¹H McLafferty rearrangement – Retro Diels-Alder reaction, interpreting the mass spectra of Pentane, Pentan-3-one and ¹H 2-methyl butane.

Self-study: Instrumentation of NMR spectroscopy and Mass spectrometry

Unit V Photochemistry and Green Chemistry

(12 hrs)

Introduction: Thermal and photochemical reactions - comparison. Naturally occurring photochemical process - examples. Allowed and forbidden transitions. Jablonski Diagram. Photochemical process- photoreduction, photodimerization, photoisomerization and photochemical rearrangements - Definition and example. Norrish type – I & II reactions and mechanism. Introduction - Need for green chemistry - Twelve principles of green chemistry - Selection of appropriate solvents – supercritical carbon dioxide, ¹H ionic liquids and water - ¹H Solvent free reactions – Deacetylation and saponification.

Self-study: Microwave Assisted Organic Synthesis

Activity based Learning

1. Molecular model construction for heterocyclic compounds.
2. Mechanism mapping and reaction prediction exercises.
3. Spectral interpretation using NMR and mass spectra.
4. Virtual demonstrations of advanced organic reactions.
5. Solvent-free and green synthesis laboratory activities.
6. Case studies on medicinal chemistry and sustainable chemical processes.
7. Skill acquirement on photochemical reactions and green chemistry.

TEXTBOOKS

1. B.S. Bahl and Arul Bahl, Advanced Organic Chemistry, Reprint 2010, S. Chand & Company Ltd.
2. V.K. Ahluwalia & P.K. Parashar, Organic Reaction Mechanism, 2nd Edition, 2005, Narosa Publishing House.
3. Y. R. Sharma, Elementary organic spectroscopy, S. Chand & company Ltd.
4. V. Kumar, An introduction to Green chemistry, First edition, 2007, Vishal publishers.
5. Jagdamba singh, Jaya singh, Photochemistry and pericyclic reactions, Revised second edition, New Age International publishers.

REFERENCES

1. M.K. Jain & S.C. Sharma, Modern Organic chemistry, 3rd edition, 2009, Vishal Publishing Co.
2. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976).
3. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).
4. Pine S.H, Organic Chemistry, (4th edition) New Delhi, McGraw- Hill, International Book Company. (1986).
5. Mehta, B. and Mehta.M, Organic chemistry, PHI learning Pvt. Ltd., New Delhi(2012).

Core- INORGANIC CHEMISTRY –IV

Subject code: 26UCHC62

Semester: VI	Core :T10	Credits : 3	Hours/W – 4
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Course outcomes

On completion of the course, the students will be able to

- CO 1 :** Recall and explain the assumptions, limitations, applications and comparisons of VBT and CFT (K1&K2)
- CO 2 :** Analyze substitution mechanisms in both octahedral and square planar complexes (K4)
- CO 3:** Apply the 18-electron rule and hapticity notation in organometallic complexes and reaction steps involving organometallic catalysts (K3)
- CO 4 :** Apply the concepts of term symbols, selection rules, microstates, and Orgel diagram to predict the electronic transitions in complexes (K3)
- CO5:** Evaluate ESR spectral data for Cu^{2+} and Mn^{2+} complexes and biological redox systems such as haemoglobin, cytochromes, ferredoxin, and Vitamin B₁₂ (K5)
- CO 6:** Construct MO diagram for coordination complexes and design a metal organic framework for the specific applications (K6)

Unit I Coordination Chemistry-II

(12 hrs)

Valence bond theory (VBT) - Assumptions - Applied to octahedral, tetrahedral and square planar complexes - Limitations - Crystal field theory(CFT) - Assumptions - Splitting of d- orbitals in octahedral and tetrahedral complexes - Crystal field splitting, pairing and crystal field stabilization energies - Δ_o & Δ_t - comparison - Factors affecting the magnitude of crystal field splitting - *High spin and low spin complexes - Consequences of crystal field splitting - Applications of CFT to octahedral, tetrahedral and square planar complexes - Limitations of CFT. Comparison of VBT and CFT

Self-study: Colour and magnetic properties of metal complexes (CFT)

Unit- II Coordination Chemistry-III

(12 hrs)

MO theory-sigma bonding in octahedral complexes. Sigma bonding in octahedral complexes $[\text{CoF}_6]^{3-}$ and $[\text{Co}(\text{NH}_3)_6]^{3+}$. Jahn Teller distortion. Labile and inert coordination compounds. Stability and factors affecting the stability of metal complexes. $\text{S}_{\text{N}}1$ – Dissociative mechanism. $\text{S}_{\text{N}}2$ –Associative mechanism. $\text{S}_{\text{N}}1\text{CB}$ – mechanism. Substitution reactions. Square planar substitution reaction. Factors affecting reactivity of square planar complexes. Trans effect and its series - Theories of trans effect. Inner sphere and outer sphere mechanism.

***Self-study:** Thermodynamic and kinetic stability of metal complexes

Unit III Organometallic Chemistry and Catalysts (12 hrs)

Organometallic compounds. Types of organometallic compounds. Hapticity - Ligands in organometallic compounds. 18-Electron rule-applications and limitations. Nature of bonding in metal carbonyls. σ and π back donation. Zeise's salt. Bonding and structure of mono and poly nuclear – Fe, Co and Ni carbonyls. Organometallic compounds-catalysts – Oxidative addition - Reductive elimination -Hydrogen abstraction - Insertion reaction - Hydrogenation of olefins-Wilkinson's catalyst - *Ziegler-Natta catalyst-Hydroformylation-oxo process

Self-study: Synthesis and properties of metal carbonyls, bridging and terminal carbonyls

Unit IV Physical Methods in Inorganic Chemistry (12hrs)

Electronic spectra - Types of electronic transitions -Spin and Laporte selection rules - Spectroscopic ground state term symbol - Microstates -Combined Orgel-energy diagram for d^1 and d^2 states - *Electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{V}((\text{H}_2\text{O})_6)]^{3+}$ complex ions - Electronic spectrum of Co(II), Ni(II) and Cu(II) complexes. Spectra of the lanthanides and actinides. Electron paramagnetic spectra - Hyperfine splitting and g-factor - Zero field splitting and Kramer's degeneracy - Applications of ESR spectra to Cu (II) and Mn (II) complexes

***Self-study:** Charge transfer spectra – Ligand to metal and metal to ligand

Unit V Bio-Inorganic Chemistry and Coordination Polymers (12 hrs)

Essential and trace elements in the living system. Haemoglobin -Structural features and functions of Haemoglobin. Cyanide poison and Carbon monoxide poison. Electron transfer- Cytochromes. Rubredoxin, Ferredoxin, Photosynthesis-Chlorophyll, Vitamin-B₁₂. Iron Inventory and storage in the human body. Porous coordination polymers – Metal organic framework (MOF). Synthesis methods – conventional and unconventional Self-assembly, Application of MOF materials – Catalysis, storage and sensors

***Self-study:** Biological functions and toxicity of metal ions and role of myoglobin in biological system

Activity based Learning

1. Construction of coordination and organometallic molecular models.
2. Crystal field splitting and CFSE calculations.
3. Mechanism mapping for ligand substitution and catalytic cycles.
4. Interpretation of UV–Visible and ESR spectra.
5. Clinical case studies in bioinorganic chemistry.
6. MOF design using molecular modelling software or model kits.
7. Seminar presentations on catalysts, MOFs, and metalloproteins.
8. Collaborative problem-solving using spectral and mechanistic data.

REFERENCES:

1. B.R. Puri and L.R. Sharma, Principles of Inorganic chemistry, Revised Edn, 2006, Milestone Publications. Albert Cotton, Wilkinson, Basic Inorganic chemistry, 3rdEdn, 2007, John Wiley Pvt. Ltd.
2. J. D. Lee, Concise Inorganic Chemistry, 5th Edn, 1996, Blackwell Pub.Com.
3. D.E. Shriver, P. W. Atkins, Inorganic chemistry, 5th Edn, 2010, Oxford Univ. Press.
4. J. E. Huheey, Inorganic chemistry, Principle of structure and reactivity. 4thEdn, 1996, Pearson Education.
5. R. S. Drago, Physical methods in chemistry, 1st edition, Philadelphia, W.B. Saunders Company.
6. E. A. V. Ebsworth – Structural methods in Inorganic chemistry, 1st edition, Blackwell scientific publications
7. Bertini, H.B. Lippard and J.S. Valentine, Bioinorganic Chemistry, University Science Books
8. R.D. Madan, Principles of Inorganic chemistry, Revised Edn, 2011, S. Chand & Co Ltd.
9. R. Gopalan, V. Ramalingam, Concise Coordination chemistry, Vikas Publishing House Pvt Ltd.
10. Asim K. Das, Bioinorganic chemistry, Books and Allied (P) Ltd.

PHYSICAL CHEMISTRY – III

Subject code: 26UCHC63

Semester : VI

Core : T 11

Credits : 4

Hours/W - 4

Course outcomes

On completion of the course, the students will be able to

CO1: Define the factors affecting the rate of chemical reactions and state methods for determining reaction rates (K1)

CO2: Explain the thermodynamic principles underlying operation of concentration cells and describe the relationship between cell potential and concentration (K2)

CO3: Predict the quantum yield and apply photochemical concepts to classify different Types of photochemical reactions (K3)

CO4: Identify and analyze the similarities and differences among various types of batteries based on their components and working principles (K4)

CO5: **Compare** and evaluate the variation of conductance with different factors such a concentration, temperature, and nature of electrolytes (K5)

CO6: Design and fabricate a series of electrochemical cells or batteries based on electrochemical principles (K6).

Unit I Chemical Kinetics – I

(12 hrs)

Thermodynamic feasibility and kinetic feasibility. Fundamental concepts – rate of formation, rate of consumption, extent of reaction and rate of reaction – initial rate and average rate. *Conventional methods of measuring rates. Qualitative idea of the factors affecting rate. Empirical rate equations (IKS) – partial order, overall order – examples of first order, second order, third order, zero order and fractional order reactions – pseudo first order reactions – units of rate constant. Isolation method and initial rate method of determination of kinetic order and rate constant. Integrated rate laws for first order and second order reactions – *derivation and discussion – half-life time. Elementary reactions and molecularity. Kinetic study - First order reactions – *dehydration of oxalic acid, *inversion of cane sugar, decomposition of aqueous H_2O_2 , hydrolysis of methyl acetate in aqueous solution, thermal decomposition of azo-isopropane - Second order reactions – *saponification of an ester by an alkali - *Zero order reaction – iodination of acetone in presence of mineral acid.

Self-Study: Order, molecularity, half-life, activation energy.

Unit II Chemical Kinetics –II and Photochemistry

(12 hrs)

Theories of rates of homogeneous reactions - Effect of temperature on reaction rate – Arrhenius rate equation – activation energy – significance and determination of

Arrhenius parameters - Collision theory of bimolecular reactions – Lindemann’s theory of unimolecular reactions - Simple version of transition state theory of bimolecular reactions - Catalysis – homogeneous and heterogeneous catalysis – auto catalysis – negative catalysis – catalytic poisoning – intermediate compound formation theory and adsorption theory – Biological or enzyme catalysis(IKS) and discussion of its mechanism characteristics of enzyme catalysis. Photochemistry - Difference between thermal and photochemical reactions - Photon energy – Einstein energy – Intensity - Lambert’s law – Beer’s law – Beer-Lambert’s law and its limitations - Grotthus and Draper law – Stark & Einstein’s law -Quantum yield – low and high quantum yields – experimental determination using uranyl oxalate actinometer - Free radicals and chain reactions – H_2+Cl_2 and CH_4+Cl_2 (derivation of rate laws not expected) -Qualitative description of fluorescence and phosphorescence and their mechanism - *Chemiluminescence and bioluminescence – *Photography

Self-Study: Homogeneous reactions, heterogeneous reactions with examples

Unit III Electrolytic Conductance

(12 hrs)

Electrical conductance, cell constant and electrolytic conductivity - κ and its determination. Molar conductivity (λ) and its variation with concentration of strong electrolytes and Kohlrausch’s empirical relation. Weak electrolytes – Arrhenius theory – degree of dissociation and its relation to λ – evidence in favour of the theory of electrolytic dissociation – *Kohlrausch law of independent migration of ions and *Ostwald’s dilution law and their applications – experimental verification of Ostwald’s law. Drawbacks of Arrhenius theory. Theory of strong electrolytes – relaxation effect – electrophoretic effect – Onsager conductivity equation (derivation not expected). Influence of temperature, solvent and viscosity on conductance. Contribution of individual ions to λ_0 – *transport number (λ) and *ionic mobility (u) – relation between them – determination of ‘t’ by Hittorf method and by moving boundary method – Applications of t and u. Conductometric titrations. *Applications of conductivity measurement

Self-Study: Electrolytes, conductance, conductivity, specific conductance, equivalent conductance, molar conductance.

Unit IV Electromotive Force (EMF) – I

(12 hrs)

Requirements of an electrochemical change. Distinction between electrolytic and

galvanic cells. Origin of potential – standard electrode potential – electrochemical series. Conventions in electrode/half-cell representation– half cell reactions - cell representation – cell reaction. Types of electrodes – metal and metal ion, metal amalgam, metal – insoluble metal salt and metal – salt ion electrodes – *redox, gas and membrane electrodes – description of hydrogen gas electrode, calomel electrode and glass electrode.*Reversible cells and cell reactions. *Weston standard cell – measurement of emf – calculation of single electrode potentials. Nernst emf equation and *calculation of cell emf. *Calculation of ΔG , ΔH , ΔS and K from emf data.

Self-Study: Electrode- Cell-emf

Unit V EMF – II

(12 hrs)

Activity, activity coefficients, mean activity, mean molal and mean molar ionic activity coefficients with regard to solutions. Chemical cell without transference – calculation of activity and mean activity. Chemical cell with transference – liquid junction potential (LJP) – *salt bridge. Concentration cell without transference – calculation of emf. Concentration cell with transference – calculation of LJP and *transport number. * Potentiometric titrations. Determination of pH using hydrogen electrode, quinhydrone electrode and glass electrode. Primary and secondary cells. *Fuel cells. Commercial cells – * Dry cells (Zn, MnO_2 , alkaline cell, Ni-Cd cell) – Storage batteries (lead storage battery, Edison storage battery). Corrosion – electrochemistry of corrosion. Corrosion inhibitors – corrosion control – use of corrosion inhibitors - sacrificial anode – cathodic protection. *Applications of electrolysis: *Purification of metals and electroplating

Self-study: Electrochemistry, anode, cathode, electrode reactions

TEXTBOOKS

1. P.L Soni and D.P. Dharmarha, Textbook of Physical Chemistry, 1980 ed, Sultan Chand & sons.
2. S.H. Maron and C.F. Prutton, Principles of Physical Chemistry, Oxford & IBH Publishing Co. Pvt. Ltd.
3. Puri, Sharma and Pathania, Principles of Physical chemistry, 2001, Shoban Lal Nagin& Co., Vishal
4. Philip Matthews, Advanced chemistry, Low price ed. 1996, Cambridge University press.
5. K. J. Laidler and J.H. Meiser, Physical chemistry, CBS

Selected topics in Chemistry
Subject code: 26UCHE61

Semester : VI EC:T7 Credits : 2

Hours/W - 1

Course outcomes

On completion of the course, the students will be able to

- CO1:** Define the fundamental concepts related to metals in medicine, surface chemistry, smart materials, drug action, and clinical chemistry (K1)
- CO2:** Explain the principles underlying toxic metal effects, adsorption phenomena, functional Materials behaviour, pharmacological mechanisms, and clinical diagnostic methods (K2)
- CO3:** Apply chemical and biochemical principles to interpret drug metabolism, adsorption processes, diagnostic tests, and therapeutic uses of metal-based compounds (K3)
- CO4:** Analyze the relationships between chemical structure and biological activity in drugs, the role of materials in advanced applications, and clinical data for disease identification(K4)
- CO5:** Evaluate the effectiveness of therapeutic agents, diagnostic techniques, and material applications in medicine, industry, and healthcare (K5)
- CO6:** Design innovative approaches utilizing chemical knowledge for developing functional materials, drug related solutions, or diagnostic strategies (K6)

Unit I Metals in Medicine

(6 hrs)

*Toxic metals – lead, mercury (IKS), cadmium and arsenic – sources and health effects. Metal overload diseases – Wilson’s disease and hemochromatosis. Chelation therapy – EDTA, dimercaprol, penicillamine and desferrioxamine. *MRI contrast agents-gadolinium complexes. Radiopharmaceuticals- technetium complexes. *Therapeutic Agents- Platinum, Gold, Bismuth and Lithium compounds.

Self-Study: Nanometals and metal nanoparticles in medicine

Unit II Polymeric materials

(6 hrs)

*Definition of polymers, monomers, oligomers. Classification of polymers, Natural, synthetic, semi-synthetic, Linear, branched, cross-linked, Thermoplastics and thermosets, Polymerization Reactions-Addition, Condensation and free radical polymerization. *Conducting polymers, *Biopolymers, Biodegradable polymers, Polymer composites, *Green polymers and sustainable materials

Self-study: Properties of polymers

Unit III Smart and Functional Materials

(6 hrs)

Introduction to smart and functional materials – definition, classification, and characteristics. Stimuli-responsive materials – types and mechanisms (temperature, pH, light, electric and magnetic field responsive materials). Shape memory materials – shape memory alloys and polymers – principles and applications. Piezoelectric and ferroelectric materials – properties and applications in sensors and actuators. Self-healing materials – concept, mechanisms and applications.

Self-Study: Applications of smart materials in medicine, aerospace, robotics, environmental monitoring, and energy devices.

Unit IV Drugs, Action of Mechanism and Metabolism of Drugs

(6hrs)

Introduction, Sources of drugs- Pharmacodynamics, Pharmacokinetics & molecular pharmacology-Pharmacophore, chemotherapy-Mechanism of action-drug-receptor complex—Chemistry Drug-receptor binding-metabolism of drugs-Absorption of drugs *Routes of Administration.

Self-study: Agonists and antagonists, Absorption of drugs – factors affecting absorption

UNIT V Clinical Chemistry and Common Diseases

(6hrs)

Determination of sugar in serum-Folin and Wu's method-o-toluidine method. Sackett's method of determination of total cholesterol. *Detection of Diabetes and anaemia. Infective and hereditary diseases-Insect borne diseases and their treatment- Airborne diseases and their treatment - Water borne diseases.

***Self-study:** First Aid for Accidents

References:

1. Bertini, I., Gray, H. B., Lippard, S. J., & Valentine, J. S. Bioinorganic Chemistry, 1994, University Science Books
2. Atkins, P., & de Paula, J. Physical Chemistry, 2014 (10th Edition), Oxford University Press
3. Gandhi, M. V., & Thompson, B. S., Smart Materials and Structures, 1992, Chapman & Hall.
4. Patrick, G. L. An Introduction to Medicinal Chemistry, 2017 (6th Edition), Oxford University Press.
5. Sood, R. Medical Laboratory Technology, 2006, Jaypee Brothers Medical Publisher

GREEN CHEMISTRY
(Subject code: 26UCHE61)

Semester: VI EC: T7 Credits: 1 Hours/W: 2

Course outcomes

On completion of the course, the students will be able to

CO1: Define the concepts, goals, and principles of green chemistry (K1)

CO2: Explain the principles and mechanisms involved in microwave-mediated organic synthesis (K2)

CO3: Apply green chemistry methodologies to carry out organic transformations (K3)

CO4: Analyze the impact of different green synthesis approaches (K4)

CO5: Evaluate the advantages and limitations of green chemistry techniques (K5)

CO6: Design environmentally benign synthetic routes using green chemistry principles for organic reactions (K6)

UNIT-I Introduction to Green chemistry (6 hrs)

*Introduction- Green chemistry -relevance and goals, Anastas' twelve principles of green chemistry. Tools of green chemistry: alternative starting materials, reagents, catalysts, solvents (IKS) and processes with suitable examples.

UNIT-II Microwave mediated organic synthesis (MAOS) (6 hrs)

Introduction- *Microwave activation - advantage of microwave exposure- specific effects of microwave -Neat reactions -solid support reactions- Functional group transformations- condensation reactions -oxidations – reductions reactions, *multi-component reactions

UNIT III Ionic liquids and PTC (6 hrs)

Introduction- synthesis of ionic liquids - physical properties-applications in alkylation – hydroformylations – oxidations – *synthesis of ethers – Friedel-craft reactions – Diels-Alder reactions – Knoevenagel condensations – *Wittig reactions - Phase transfer catalyst - *Synthesis – applications

UNIT IV Supported catalysts and bio-catalysts for green chemistry (6 hrs)

Introduction - The concept of atom economy - supported metal catalysts – mesoporous silicas- The use of Biocatalysts for green chemistry -Modified bio catalysts – fermentations and bio transformations – fine chemicals by microbial fermentations – vitamins and amino acids-Baker's yeast mediated bio transformations- Bio-catalyst mediated *Baeyer-Villiger reactions – Microbial polyester synthesis

UNIT - V: Sonication and electro organic Reactions (6 hrs)

Sonication reactions – Introduction- Barbier reaction-Reformatsky reaction- Simmons-Smith reaction - Ullmann coupling reaction-Wurtz reaction-electroorganic chemistry – introduction – *anode, *cathode, cell and electrolyte-Kolbe oxidation- *Electro reduction reactions

References

1. Green Chemistry – Environmentally benign reactions – V. K. Ahluwalia. Ane Books India (Publisher). (2006).
2. Green Chemistry – Designing Chemistry for the Environment – edited by Paul T. Anastas & Tracy C. Williamson. Second Edition, (1998).
3. Green Chemistry – Frontiers in benign chemical synthesis and processes- edited by Paul T. Anastas & Tracy C. Williamson. Oxford University Press, (1998).
4. Green Chemistry – Environment friendly alternatives- edited by Rashmi Sanghi & M. M. Srivastava, Narora Publishing House, (2003).
5. Green Chemistry- V. K. Ahluwalia, 2nd Ed., Ane Books Pvt Ltd., New Delhi, 2016.
6. Organic electro chemistry by Henning Lund & Ole Hammerich, 4th edition, Publisher: Marcel Dekker, Inc, New York.

PHYSICAL CHEMISTRY PRACTICAL-I

Subject code: 26UCHCP61

Semester : VI	Core : P7	Credits : 2	Hours/W – 4
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Course outcomes

On completion of the course, the students will be able to

- CO1:** Recall the principles, laws, and theories governing thermodynamics, kinetics, phase equilibria, adsorption, and solutions. (K1)
- CO2:** Explain the concepts of colligative properties, transition phenomena, partition equilibrium, adsorption isotherms, and reaction kinetics. (K2)
- CO3:** Perform physical chemistry experiments to determine thermodynamic, kinetic, and Equilibrium parameters. (K3)
- CO4:** Analyze experimental data to evaluate phase diagrams, rate constants, equilibrium constants, and thermodynamic properties. (K4)
- CO5:** Evaluate the accuracy and validity of experimental results by comparing them with theoretical predictions and literature values. (K5)
- CO6:** Design and interpret investigations involving physicochemical systems using appropriate experimental and data-analysis methods. (K6)

Electrical and Non – electrical experiments

1. Determination of Molal depression constant (K_f) of naphthalene and molecular weight of a solid solute (Rast Method)
2. Determination of Integral heat of saturated solution of oxalic acid (solubility method)
3. Determination of Solubility product of calcium hydroxide using common ion effect at low temperatures
4. Determination of Critical solution temperature (C.S.T) and composition at C.S.T of phenol – water system
5. Determination of Transition temperature of a salt hydrate (thermometric method)
6. Determination of Rate constant of hydrolysis of ethyl acetate catalyzed by dil. HCl
7. Determination of Partition coefficient of iodine between CCl_4 and H_2O and stability constant of the complex KI_3
8. Determination of Eutectic temperature and eutectic composition from the experimentally constructed phase diagram of a system involving one eutectic.
9. Determination of enthalpy of neutralization of strong acid and strong base
10. Verification of Freundlich adsorption isotherm using animal charcoal and oxalic acid
11. Determination of rate constant of zero order reaction of iodination of acetone
12. Determination of rate constant of inversion of sucrose using polarimeter

NOTE: Laboratory manual will be supplied.

QUALITATIVE ANALYSIS OF ORGANIC COMPOUNDS (PRACTICAL)

Subject code: 26UCHP62

Semester : VI	Core: P8	Credits: 2	Hours/W – 4
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Course outcomes

On completion of the course, the students will be able to

- CO1:** Recall the principles and tests used for the identification of organic compounds. (K1)
- CO2:** Explain the basis of classification, elemental detection, and functional group identification. (K2)
- CO3:** Perform systematic qualitative analysis to identify unknown organic compounds (K3)
- CO4:** Analyse experimental observations to determine the nature and functional groups of compounds. (K4)
- CO5:** Evaluate analytical results through confirmatory tests and derivative preparation. (K5)
- CO6:** Design a logical scheme for the identification and characterisation of unknown organic compounds. (K6)
1. Aliphatic/aromatic nature
 2. Saturated/unsaturated nature
 3. Elements present and absent (N, S and halogens)
 4. Functional group present
 5. Confirmation of the functional group by preparing a solid derivative or a colour reaction.

NOTE: Laboratory manual will be supplied.

PHYSICAL CHEMISTRY PRACTICAL-II

Subject code: 26UCHEP61

Semester : VI	EC : P4	Credits :1	Hours/W – 2
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Course outcomes

On completion of the course, the students will be able to

- CO1:** Recall the principles and instrumentation of conductometric, potentiometric, and spectrophotometric methods. (K1)
- CO2:** Explain the theoretical basis of electroanalytical and spectroscopic techniques used in chemical analysis. (K2)
- CO3:** Perform conductometric, potentiometric, and spectrophotometric experiments for quantitative analysis (K3)
- CO4:** Analyze experimental data to determine concentrations, rate constants, and equilibrium parameters. (K4)
- CO5:** Evaluate the accuracy and reliability of instrumental methods through interpretation of analytical results.
- CO6:** Design analytical procedures using suitable instrumental techniques for chemical investigations.

Experiments

1. Determination of Strength of HCl solution using standard NaOH solution (conductometry)
2. Determination of Strength of HCl solution using standard NaOH solution (potentiometry)
3. Determination of Strength of ferrous ammonium sulphate (FAS) solution using standard KMnO_4 solution (potentiometry)
4. Verification of Onsager conductivity equation using KCl and determination of the strength of a test KCl solution.
5. Verification of Beer – Lambert's law of KMnO_4 and determination of molar absorptivity at wavelength of maximum absorption (max) (for demonstration only)
6. Conductometric determination of second order rate constant - saponification of ester
7. Conductometric precipitation titration between silver nitrate and potassium chloride
8. Potentiometric precipitation titration between silver nitrate and potassium chloride
9. Determination distribution constant and equilibrium constant for iodine potassium iodide equilibrium

PROJECT WITH VIVA VOCE
Sub. Code: 26UCHC67

Semester: VI	Core	Hrs/W: 6	Credits: 2
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Structure of the Project Report

1. Cover Page
2. Certificate
3. Declaration
4. Acknowledgement
5. Chapter-I Introduction
6. Chapter-II Literature Survey
7. Chapter-III Objectives
8. Chapter-IV Experimental
9. Chapter-IV Result and Discussion
10. Chapter-V Conclusion and Scope for further work
11. Chapter-VI Bibliography

Assessment

Internal: 100 Marks

External: 100 Mar

COMPUTER APPLICATIONS IN CHEMISTRY

Subject code: 26UCHS61

Semester: VI

SEC: 6

Credits: 2

Hours/W: 2

Course outcomes

On completion of the course the students should be able to

CO 1 :Use C language to solve chemistry problems (K5)

CO 2 :Gain the ability to apply chemdraw (K4)

CO 3 :Ability to use chromatography techniques in research (K4)

CO 4 :Describe easy way to solve problems using computer languages (K2)

CO 5 : Recite the important terms related with computer and analytical techniques. (K1)

CO 6 : Familiarized in analysing thermos analytical data and using Chemistry software (K5)

UNIT I: Introduction to C

(6 Hours)

Development of C – High level language – Importance of C – A simple C program, - Layout of a C program – Compiling C programs – Shortcut Keywords in C program - Character set – Keywords and identifiers – Formal variables, Local variables and Global variables– Consonants of different Data types, Special back slash consonants- Declarations – Exercises

UNIT II Operators used in C

(6 Hours)

Arithmetic operators – Increment and Decrement operators – Relational operators – Logical operators – Assigned operators – Bit Wise operator – Ternary operator – Cast operator – Coma operator –Size of operator – Exercises

UNIT III Statements in C

(6 Hours)

Input and Output statements - Getchar () function - Putchar() function – Gets () function – Puts () function – Formatted Input function – Formatted our put statement – GOTO statement – Looping – If statement, If – else statement, Loop in C, Do-While Loop

UNIT IV Applications in Chemistry

(6 Hours)

Program to compute molarity & Normality of a solution – program to convert Farenhite to Centigrade - Determination of /Calculation of (1) Bohr radius (2) Energy of electromagnetic radiations (given: Wavelength or frequency) (3) Enthalpy change using Clapeyron-Clausius Equation (4) Rate constant for a first order reaction (5) pH of a buffer solution (using Henderson's equation)

UNIT V Chemwares

(6 Hours)

Introduction to chemware - Drawing chemical structures using chemdraw/KingDraw chemical structure editor - Drawing 3-dimensional chemical structures - Analysing structural data - Prediction of properties of compounds- Interpretation of ^1H and ^{13}C NMR details of simple compounds - SMILES coding - Chemical database - Full structure search

***Experimental techniques in chemistry**
(Add-On course for I UG)
(Subject code: 26UCHAO1)(Only Internal)

Semester: II	Add-On	Credits: 2	Hours/W: 2
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Course outcomes

On completion of the course, the students will be able to

- CO 1** :Understand the basic and special apparatus used in chemistry lab (K1)
- CO 2** :Handle special apparatus and reagents for analysis (K4)
- CO 3** :Gain fundamental knowledge on basic units (K2)
- CO 4** :Calculate and work with unit conversions (K3)
- CO 5** :Practice laboratory safety measures during their stay in chemistry labs (K4)
- CO 6** : Handle purification and separation processes effectively (K4)

Unit I Basic Laboratory Apparatus

6 Hours

Flasks – conical – round bottom – beakers – tubes – test, boiling and transition – wire gauze – funnels – china dish – condensers – filter paper – desiccators – separating funnel – crucibles –silica and sintered – burette – pipette – measured cylinders – standard measuring flasks – Bunsen burner – flames – oxidizing and reducing.

Unit II Measurements and Units

6 Hours

Accuracy – precision – weighing – physical and chemical balances – digital balance – volume measurements – meniscus – concordance – thermometers – barometers – stop watches – tabulation of data – graphs.

Unit III Basic concepts in experiments

6 Hours

Solubility – density – concentration – collection of gases – upper and lower displacement – solubility of gases – NH_3 , CO_2 , Cl_2 , H_2 , HCl , O_2 and SO_2 – drying of gases – passing through concentrated H_2SO_4 and fused CaO .

Unit IV Separation and Purification

6 Hours

Importance of pure substance – medicinal and food materials – pure substances and mixtures – effects of impurity – miscibility temperature, transition temperature, boiling point, melting point and vapour pressure – measurement of boiling point and melting point – decantation – filtration– crystallization – preparation of saturated solution – distillation – fractional distillation – drying – water bath – sand bath – sublimation.

Unit V Lab safety

6 Hours

Code of conduct in laboratories – symbols on chemicals – accidents – intoxications – acid burns – alkali burns – cuts – safety measures

Food Chemistry
(Value added course for II UG)
(Subject code: 26UCHVA1) (Only Internal)

Semester: IV	Value added	Credits: 2	Hours/W: 2
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Course outcomes

On completion of the course, the students will be able to

CO 1 : Identify food adulterants in food stuffs (K2)

CO 2 : Know the types of food additives and their importance in preservation(K1)

CO 3 : Estimate the food value of various food items (K4)

CO 4 : Prepare natural food based on the nutritional requirements (K3)

CO 5 : Recommend people to use natural preservative techniques to common people (K5)

CO 6 : Trace out the food allergy symptoms on living organisms (K3)

Unit I Food Adulteration and Testing **6 hrs**

Introduction- Legal aspects of Food adulteration and Prevention. Common food adulterants- Analysis of various food adulterants-Pesticide contaminants- Toxicants.

Unit II Food Allergy **6 hrs**

Food as Allergens-Types of reactions-Symptoms- Diagnosis- Treatment

Unit III Food Additives **6 hrs**

Food additives –Introduction, types & functions-Categories of food additives- Safety concerns and Legal Regulations of Food additives-Food flavour-Sensation of smell & taste- Flavour of some important foods-Natural Food colours - Carotenoids, Caramel, Tannins, Betalains- Important Artificial colours.

Unit IV Food Processing and Preservation **6 hrs**

Introduction-Aims of food processing-Food preservation -introduction-Means of Preservation- Types of spoilage-Various methods of food preservation

Unit V Edible Oils **6 hrs**

Fats and Oils-Production of refined vegetable oils-Saturated and unsaturated fatty acids- Role of MUFA and PUFA in preventing heart diseases-Estimation of I2 value & RM value -Estimation of saponification value and their significance

TEXTBOOKS:

1. Alex V Ramani, Food Chemistry, MJP publishers
2. H. K. Chopra & P. S. Panesar, Food Chemistry, Narosa Publishing House
3. B. Srilakshmi, Dietetics, New age international (P) Ltd. Publishers
4. Swaminathan M., Food Science and Experimental methods, Ganesh and Company.
5. S. A. Joshi, Nutrition and dietetics, tata McGraw-Hill publishing companies

EXTRA CREDIT COURSES FOR U. G. (Self-Study)
ECC- ANALYTICAL CHEMISTRY
(SUB CODE: 26UCHEC1)

Semester: I	ECC-I	Credits: 2
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Course outcomes

On completion of the course the students should be able to

CO1: Recall laboratory apparatus, analytical techniques, and instrumental components used in chemical analysis (**K1**)

CO2 : Explain principles of thermogravimetric, chromatographic, and spectroscopic analytical methods (**K2**)

CO3: Apply calibration, pH measurement, chromatographic, and spectroscopic techniques in analysis(**K3**)

CO4 :Analyze experimental and instrumental data using statistical and error analysis methods (**K4**)

CO5 : Evaluate accuracy, precision, uncertainty, and reliability of analytical results (**K5**)

CO6 : Develop calibration curves, interpret analytical data, and maintain proper laboratory records.(**K6**)

UNIT I Analytical Methods

Description and use of common laboratory apparatus – calibration and use of volumetric glass ware – pH meter: components of pH meter, use of pH meter, maintenance of pH meter, application of data, Laboratory note book

Unit II Principles of Thermogravimetry

Thermometric methods – principles of TGA, DTA and HCl vs NaOH thermometric titrations – Applications $\text{CaC}_2\text{O} \cdot \text{H}_2\text{O}$, $(\text{CH}_3\text{COO})_2\text{Ca} \cdot \text{H}_2\text{O}$

UNIT III Principles of Chromatography

Chromatography(IKS) – Principle, theory, instrumentation and applications in chemical analysis of the following – column, paper, thin layer and ion-exchange – GC, GLC and HPLC.

UNIT IV Spectroscopy methods

Principle, theory, instrumentation and applications in chemical analysis of the following: Atomic Absorption Spectroscopy, Flame Emission Spectroscopy, Fluorimetry

UNIT V Errors in Chemical Analysis

Types of errors - Accuracy and Precision, Absolute and relative uncertainty, propagation of Uncertainty- The Gaussian distribution, mean and standard deviation, confidence Intervals - Statistical tests of data (the F test, the t test, Q test for bad data, the method of least squares-Calibration curve-Safety with chemicals and waste.

TEXTBOOKS

1. Practical Manual of Instrumental Method of Analysis – Pradeep Sarkate, Prerna Chaturvedi & Sumeet Dwivedi (Deep Science Publishing, 2025).
2. Practical Chemistry: Instrumental Analysis and Quantitative Analytical Chemistry – Kasaye Bahiru

Tola & Girma Salale Geleta (De Gruyter, 2025).

3. Instrumental Methods of Chemical Analysis – V. K. Ahluwalia (Springer, 2023/2024).
4. Analytical Chemistry: Basic Techniques and Methods – Priti Malhotra (Springer, 2023/2024).
Textbook explaining foundational analytical methods, including spectroscopy and thermal methods, with pedagogical examples.

ECC- LEATHER CHEMISTRY
(SUBCODE:26UCHEC2)
(FOR SELF-STUDY ONLY)

SEMESTER-II	ECC -2	CREDITS -2
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Course Outcomes

On completion of the course, the students will be able to

- CO 1 : Students will gain the ability to formulate and solve problems (K5)
- CO 2 : Design their own life-oriented application of chemistry (K5)
- CO 3 : Classify the applications of leather in different segments. (K4)
- CO 4 : Assess the impact of leather making on society (K5)
- CO 5 : Define the properties of leather and leather products (K1)
- CO 6 : Explain the composition, types, preservation and uses of milk and milk products (K1)

UNIT I Introduction to Leather Chemistry

Importance of leather industry-Scope of leather chemistry-Distinction between hides, skins (IKS) and leather – a detailed study of the structure and composition of hides and skins. Proteins and their characteristics-Anatomy and histology of protein constituents of leather (IKS).

UNIT II Tanning Processes

Basic principles involved in pre-tanning, soaking, liming, deliming, bating, pickling and depickling-Types of tanning – vegetable and mineral tanning- Different types of vegetable tanning- Materials – classification and chemistry of vegetable tanning-Factors and physico-chemical principles involved in vegetable tanning- Fixation of vegetable tanning- Synthetic tanning – classification – general methods.

UNIT III Chemistry of Tanning

The preparation and chemistry of chrome tanning liquids-Olation, oxolation and hydrolysis of chrome liquids-Effects of adding tanning agents- Role of pH in the reaction of chromium complexes with hide proteins. Factors governing chrome tanning-Chemistry of neutralization process (IKS). A brief survey of chemistry of other tanning agents like Al, Zr and Te salts and their relative merit in contrast with chrome tanning.

UNIT IV Preservation and Processing of Leather

Chemical methods of curing and preservation of hides and skins in acid and alkaline solutions. Principle of methods employed in curing, liming, deliming, bating and pickling - Process of dyeing leather – use of mordants. Dyeing auxiliaries such as leveling, wetting and dispersing agents – Dye fixation

UNIT V Environmental Impact of Tannery Industries

Tannery effluent and treatment – Types of water pollution(IKS)-Different types of tannery effluents and wastes – solid waste – Origin and disposal-A small group project on collecting tannery effluents from various sources and their chemical analysis.

TEXTBOOK: Woodroffe, Fundamentals of leather science, John Wiley

**ECC- FORENSIC SCIENCE
(SUB CODE: 26UCHEC3)
(FOR SELF-STUDY ONLY)**

SEMESTER-III	ECC -3	CREDITS -2
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Course outcomes

On completion of the course the students will be able to

- CO 1** : Develop Critical thinking and analysis abilities. (K5)
- CO 2** : Understand the different techniques in crime detection (K2)
- CO 3** : Generate laboratory skills to exacting standards of precision and care (K6)
- CO 4** : Ability of problem-solving skills (K4).
- CO 5** : Ability to apply diverse information to solve a real problem (K5)
- CO 6** : Conceptual understanding of the criminal justice system (K3)

UNIT I Food Adulteration

Contamination of wheat (IKS), rice, dhal, milk, butter, etc. with clay, sand, stone, water and toxic chemicals (IKS) (e.g. Kesari dhal with mentanil yellow, Ground nut with aflatoxins). Food poisons: natural poisons (alkaloids, nephrotoxins), pesticides (DDT, BHC, Follidol), Chemical poisons (KCN). First aid and Antidotes for poisoned persons. Heavy metal (Hg, Pb, Cd) contamination of Seafood (IKS). Use of neutron activation analysis in detecting poisoning (e.g., As in human hair)

UNIT II Transportation

Drunken driving: breath analyzer for ethanol. Incendiary and time bombs in road and railway tracks. Defusing live bombs. Hit -and-go traffic accidents: paint analysis by AAS. Soil, toxic and corrosive chemicals (IKS) (e.g., conc. acids) from tankers.

UNIT III Crime Detection

Accidental explosions during manufacture of matches and fireworks (as in Sivakasi). Human bombs, possible explosives (gelatin sticks, RDX). Metal detector devices and other security measures for VVIP. Composition of bullets and detection of powder burns. Scene of crime: fingerprints and their matching using computer records. Smell tracks and police dogs. Analysis of blood and other body fluids in crimes. Typing of blood. DNA finger printing for tissue identification in dismembered bodies. Blood stains on clothing. Cranial analysis (head and teeth).

UNIT IV Forgery and Counterfeiting

Detecting forgery in bank cheques / drafts and educational records (mark lists, certificates), using UV-light. Alloy analysis using AAS to detect counterfeit coins. Checking silver linewater mark in currency notes. Jewellery: detection of gold purity in 22 carat ornaments (IKS), detecting gold plated jewels, authenticity of diamonds (natural, synthetic, glassy)

UNIT V Medical Aspects

AIDS: Cause and prevention. Misuse of scheduled drugs. Burns and their treatment by plastic surgery. Metabolite analysis, using mass spectrum - gas chromatography. Detecting steroid consumption (IKS) among athletes and race horses.

Textbook:

K. S. Narayan Reddy, The Essentials of Forensic Medicine and Toxicology, 12th ed., Sri Lakshmi Art Printers, Hyderabad, 1990.

***ECC- POLLUTION CONTROL**
SUB CODE: 26UCHEC4
(FOR SELF-STUDY ONLY)

SEMESTER IV	ECC - 4	CREDITS – 2
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Course outcomes

On completion of the course, the students will be able to

- CO 1 : Solve the current forms of environmental pollution (K4)
- CO 2 : Label an overview of causes and consequences of natural systems' problems (K1)
- CO 3 : Summarize the fundamental principles governing interaction between men and environment (K5)
- CO 4 : Exposition to good practice of technologies (K4)
- CO 5 : Formulate remedies to environmental problems (K6)
- CO 6 : Predict the radiation hazardous materials. (K3)

UNIT I Chemical Toxicology

Toxic chemicals in the environment-Impact of toxic chemicals on enzymes-Sources (IKS) and biochemical effects of lead, mercury, carbon monoxide and sulphur dioxide-Biochemical effects of pesticides-Carcinogens.

UNIT II Air Pollution

Air Pollutant (IKS)s-Air quality standards-Sampling and monitoring- Air pollution control – use of automobiles

UNIT III Water Pollution

Aquatic environment-Water pollutants-Trace elements in water-Water quality parameters and standards-Sampling – Preservation -Sewage treatment – Factory effluent treatment.

UNIT IV Radiation Hazards

Radiation sources-Cosmic radiation (IKS)-Effects of Radiation-Prevention measures-Radiation safety methods

UNIT V Energy Conservation

Forestation-Wood, a major renewable resource-World energy resources – consumption and conservation- Wind energy and tidal power-Environmental management

TEXTBOOKS:

1. A.K. De, Environmental chemistry, Wiley Eastern Limited
2. S.S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand

ECC- APPLIED CHEMISTRY
SUB CODE: 26UCHEC5
(FOR SELF-STUDY ONLY)

SEMESTER - V	ECC - 5	CREDITS – 2
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Course outcomes

On completion of the course, the students will be able to

- CO1: Identify the application of chemistry in industries (K1)
- CO2: Identify some important compounds and processes of industrial application (K3)
- CO3: Describe the relation between theoretical knowledge and the application in industries(K2)
- CO4: Know the importance of industrial revolution (K3)
- CO5: Apply the knowledge in all wants of life (K4)
- CO6: Construct water treatment vessels for purification of water (K6)

UNIT I Water Treatment

Impurities in water (IKS)-Temporary and permanent hardness-Softening methods-Lime soda process-Zeolite or Permutitprocess-Treatment of Brackish water -Treatment of domestic water.

UNIT II Cement

Lime- Classification of lime-Manufacture of lime(IKS)- Cement - definition-Classifications of cement-Portland cement-Manufacture of Portland cement- Setting of cement.

UNIT III Polymers

Polymers and Polymerisation-Degree of polymerization-Functionality of polymers- Types of polymers-Homopolymer-Copolymer – Homochain polymer – Heterochain polymer- stereo specific polymer-Types of polymerization and mechanism-Chain-growth polymerization-Condensation polymerization-Copolymerisation.

UNIT IV Plastic and Rubbers

Plastics and resins-Thermoplastics and thermosetting plastics-Preparations, properties and uses of Polyethylene – Polystyrene – PVC – Bakelite-Advantages and disadvantages of plastics-Natural and artificial rubber (IKS)s- Vulcanization.

UNIT V Textile Chemistry

Classification of textile fibres – Natural and synthetic fibres – Basic properties influencing wet processing –Simple structure of cellulose and polyester – Role of water in textile processing (pH – basic idea) – Common chemicals used in processing: acids, alkalis and bleaching agents – Objectives of pretreatment – Basic concepts of desizing and bleaching – Introduction to dyeing – Simple classification of dyes: Direct and Reactive dyes(IKS) – Purpose of textile finishing – Brief introduction to eco-friendly textile processing.

TEXTBOOKS:

1. N. Ravisankar, B. Narayanansamy, K. Ilangovan, Applied Chemistry, National Pathippaham
2. N. Krishnamurthy, P. Vallinayagam, K. Jeyasubramanian, Applied Chemistry, Tata McGraw Hill.
3. Sustainable Textile Chemical Processing, by Javed N. Sheikh & M. D. Teli — CRC Press (2024).

**ECC- SPACE CHEMISTRY
(SUB CODE: 26UCHEC6)
(FOR SELF-STUDY ONLY)**

SEMESTER-VI	ECC - 6	CREDITS – 2
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Course outcomes

On completion of the course the students should be able to

CO1: Identify the theory and mechanism of forces governing the universe (K1)

CO2: Ability to make observations regarding earth or space and infer conclusions from them (K4)

CO3: Explain chemical nature of different planets (K2)

CO4: Gaining idea about the fusion reactions taking place in sun and stars (K2)

CO5: Understanding laws of the universe (K2)

CO6: Interpret the light rays and study the composition of the sources (K3)

UNIT I Research Methods Used in Space Chemistry

Electromagnetic radiation (IKS)-Interaction of light radiation with matter-Light rays and chemical composition-Optical specifications of an atom-Cosmic matter on earth.

UNIT II Chemical Composition of Celestial Bodies

Meteorites-Abundance of certain elements in meteorites - Chemistry of the solar system-The planets in the solar system-Elements present in the earth crust -Composition of lunar soil and lunar rock.

UNIT III: Chemistry of Matter

Effect of pressure on matter-Effect of temperature on matter-Plasma state of matter- Optical pyrometry.

UNIT IV Stars

Brightness and luminosity of stars-The Hertzsprung-Russell diagram and stellar evolution-Chemical composition of stars-Stellar atmosphere – light and gravitation, Novae – Super Novae – Comets.

UNIT V Nuclear Reactions and Sources of Stellar Energy

Constituents of the atomic nucleus-Properties of elementary particles of atom (IKS)-Nuclear reactions – Types of nuclear reactions-Nuclear energy sources – sources of solar energy

TEXTBOOK:

L. Nikolaev, Space Chemistry, Mir Publishers, Moscow

ECC- Artificial Intelligence Applications Chemistry
(SUB CODE: 26UCHEC7)
(FOR SELF-STUDY ONLY)

SEMESTER-VI

ECC - 7

CREDITS – 2

Course outcomes

On completion of the course, the students will be able to

CO1: Define the fundamental concepts of Artificial Intelligence and its role in chemistry. (K1)

CO2: Explain AI techniques used in chemical data analysis and research applications. (K2)

CO3: Apply AI tools for solving basic chemical problems and interpreting data. (K3)

CO4: Analyze chemical information using AI-based approaches in spectroscopy and modeling. (K4)

CO5: Evaluate the effectiveness of AI applications in chemical industries and research. (K5)

CO6: Develop simple AI-based solutions or workflows for chemical applications. (K6)

UNIT I: Introduction to Artificial Intelligence in Chemistry

Definition of Artificial Intelligence – History and evolution of AI – Importance of AI in science – Role of AI in Chemistry – Overview of Machine Learning (ML), Deep Learning (DL), and Data Science – Applications of AI in chemical industries and research – Ethical considerations in AI. AI tools used in education and research.

UNIT II: Chemical Data and AI Techniques

Types of chemical data – Databases in chemistry – Data preprocessing and visualization – Introduction to algorithms used in chemistry (Regression, Classification, Clustering) – Pattern recognition in chemical data – Introduction to cheminformatics. Open chemical databases and resources.

UNIT III: AI in Molecular Modelling and Drug Discovery

Basics of molecular modelling – Structure prediction using AI – Quantitative Structure Activity Relationship (QSAR) – AI in drug discovery and pharmaceutical research – Virtual screening – Case studies. Applications of AI in medicinal chemistry.

UNIT IV: AI in Spectroscopy and Analytical Chemistry

AI applications in spectral analysis (IR, NMR, UV-Vis, Mass spectroscopy) – Image recognition in chemical analysis – Automation in laboratories – Smart sensors and AI-enabled instruments – Quality control using AI. AI-based analytical instruments.

UNIT V: AI Tools and Practical Exposure

Introduction to AI-based software and platforms – Use of AI tools for chemical problem solving – Data interpretation using spreadsheets and AI tools – AI in environmental monitoring and green chemistry – Future trends of AI in chemistry careers. AI tools for research writing and scientific communication.

Reference Books

1. Artificial Intelligence in Chemistry – Hugh Cartwright
2. Machine Learning in Chemistry – Hugh Cartwright
3. Chemoinformatics: Concepts, Methods and Tools – Johann Gasteiger

CHEMISTRY FOR BIOLOGICAL SCIENCES-I
(For Botany and Zoology students)
(SUB CODE: 26UCHE11)

SEMESTER I	EC- T1	CREDITS – 2	H/W : 4
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Course outcomes

On completion of the course, the students will be able to

- CO1** Recall the concepts of chemical bonding, atomic orbitals, hybridization, and molecular geometry. (K1)
CO2 Explain redox reactions, acid–base theories, and principles of volumetric analysis. (K2)
CO3 Apply concepts of oxidation numbers, solution concentrations, and electrochemical principles to solve chemical problems. (K3)
CO4 Analyse intermolecular forces, electrolysis processes, and conductance behavior of electrolytes (K4)
CO5 Evaluate the reactivity and distinguishing characteristics of aldehydes, ketones, carboxylic acids, amides, and amines. (K5)
CO6 Design systematic approaches to identify and predict the properties of organic compounds, amino acids, and proteins based on their structure and functionality. (K6)

Unit I: Chemical Bonding

(12 hrs)

Valency and valence electrons (IKS) - Electronic theory of valency -Electrovalency- conditions favouring electrovalency-illustration -Electrovalent compounds and their properties - covalency-conditions favouring covalency-illustration- Covalent compounds and their properties-Coordinate covalency-conditions favouring formation of the bond-illustration- Transition from electrovalence to covalency- polarisation and polarizability- Fajan's rules-statement and illustration- Atomic orbitals- Definition-charge cloud interpretation-shapes of s, p and d orbitals- Overlapping of atomic orbitals-conditions for overlap-types(s-s, s-p, and p-p) with illustrations-sigma and pi overlaps- hybridization sp^3 in CH_4 , sp^2 in BF_3 and sp in $BeCl_2$. Geometry of H_2O and NH_3 molecules- VSEPR theory.

Self-Study: Atomic number, mass number, isotopes, electronic configuration of atoms and ions.

Unit II: Redox Systems and Analytical Chemistry-I

(12 hrs)

Redox systems- Redox reactions in terms of electron transfer - Oxidation number-Definition- Rules for assigning oxidation number- Calculation of oxidation number- Redox processes in terms of oxidation number (IKS)- Advantages and disadvantages of the concept- Acids and bases- Arrhenius concept – illustration- Lowry-Bronsted concept-conjugate acid and conjugate base - Principles of volumetric analysis. Methods of expressing concentration of solution. Normality, Molarity, Molality, Mole fraction, Equivalent weights of acids bases, oxidizing agents and reducing agents. Primary standard, secondary standard, preparation of standard solution. Principles of Acid-base titrations-theory of indicators, permanganimetry, Dichrometry, Iodometry, Iodimetry.

Self-Study: Preparation of solution at different concentration, acids and bases.

UNIT III: Intermolecular Forces and Properties of Liquids

12 hrs

Polar and non-polar molecules - Dipole-dipole (Debye) forces, dipole-induced dipole (Keesom) forces, Induced dipole-Induced dipole (London) forces. Repulsive forces - Resultant intermolecular energies- Hydrogen bonding-Nature of hydrogen bonding-conditions favouring hydrogen bonding- Types of

hydrogen bonding- illustrations-impact of hydrogen bonding on melting points, boiling points and solubilities. Electrolysis (IKS) - What is electrolysis-strong and weak electrolytes - Mechanism of electrolysis - Electrical units-coulomb, Ampere, Ohm and Volt- Faradays laws of electrolysis and their importance - Conductance of electrolyte – Conductance- Specific conductance and molar conductance- Units – Variation of equivalent conductance with concentrations

Self-Study: pure covalent bonds with examples, electro negativity, conductors, insulators, boiling point, melting point

UNIT IV: Aldehydes, Ketones, Acids and Amides

12 hrs

Aliphatic aldehydes and ketones-Nomenclature-General reactions- Formaldehyde- a comparison with other aldehydes of the series - Aromatic Aldehydes-Reactions of benzaldehyde-benzaldehyde compared with acetaldehyde - Aromatic ketones-Aceton, acetophenone and benzophenone-distinction- Aliphatic saturated monocarboxylic acids-Nomenclature, general reactions(IKS)-comparison of formic acid with other acids of the series. Aromatic saturated monocarboxylic acids-distinction between benzoic acid and acetic acid - Aliphatic amides-nomenclature, general reactions - Aromatic Amides-Distinction between benzaldehyde and acetamide.

Self-Study: aliphatic compounds, aromatic compounds, Functional group of aldehydes, ketones and amides

UNIT V: Amines, Amino Acids and Proteins

12 hrs

Aliphatic monoamines - Nomenclature and classification - General reactions- Aniline- Reactions of aniline- Distinction between aniline and ethylamine- Amino acids-classification-zwitter ions-isoelectric point-preparation and properties of glycine and alanine- Proteins-introduction-peptides and polypeptides- partial hydrolysis(IKS) and terminal residue analysis in the determination of structure of peptides.

Self-Study: Functionalities of amino acids and amines, Functionalities of proteins (nitrogen containing compounds)

NOTE: Course materials will be supplied to the students.

Textbook:

1. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.
2. S. Vaithyanathan, Textbook of Ancillary Chemistry; Priya Publications, Karur,2006.
3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition,2012.
4. P. L. Soni, H. M. Chawla, Textbook of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Books

1. P. L. Soni, Mohan Katyal, Textbook of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2. B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

CHEMISTRY PRACTICAL FOR BIOLOGICAL SCIENCES-I
(for Botany and Zoology students)
(SUB CODE: 26UCHE12)

SEMESTER I	EC- P1	CREDITS – 2	H/W=2
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- CO1:** Recall the principles, reagents, indicators, and calculations involved in acid–base, redox, and complexometric titrations. (K1)
- CO2:** Explain the reactions and stoichiometry underlying volumetric estimation methods. (K2)
- CO3:** Perform acid–base, permanganimetric, dichromate, iodometric, and EDTA titrations accurately. (K3)
- CO4:** Analyze titration data to determine the concentration and purity of chemical substances. (K4)
- CO5:** Evaluate the accuracy and reliability of volumetric results through error analysis and Standardization procedures. (K5)
- CO6:** Design suitable volumetric methods for the quantitative estimation of acids, bases, oxidizing agents, reducing agents, and metal ions. (K6)

S.NO		Link	Standard
1	Strong acid	Weak base/ Strong base	Strong acid
2	Strong acid	Strong base	Weak acid
3	NaOH	Strong acid	Na ₂ CO ₃
4	Oxalic acid	Potassium permanganate	Oxalic acid
5	Ferrous sulphate	Potassium permanganate	Ferrous ammonium sulphate
6	Potassium dichromate	Ferrous sulphate	Potassium dichromate
7	Ferrous ammonium sulphate	Potassium dichromate	Ferrous sulphate
8	Potassium permanganate	Sodium thiosulphate	Potassium dichromate
9	Magnesium sulphate	EDTA	Zinc sulphate
10	Zinc sulphate	EDTA	Magnesium sulphate

Note: Laboratory manual will be supplied.

CHEMISTRY FOR BIOLOGICAL SCIENCES-II
(Subject Code: 26UCHE21)

SEMESTER II	EC- T2	CREDITS – 2	H/W=4
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Course outcomes

On completion of the course, the students will be able to

- CO1:** Recall the fundamental concepts of thermodynamics, surface chemistry, colloids, carbohydrates, stereochemistry, and analytical chemistry. **(K1)**
- CO2:** Explain the principles governing thermodynamic processes, colloidal behavior, stereoisomerism, and qualitative analysis. **(K2)**
- CO3:** Apply thermodynamic laws, adsorption concepts, and analytical principles to solve basic chemical problems. **(K3)**
- CO4:** Analyze the structure, properties, and reactions of carbohydrates, alkaloids, terpenoids, and heterocyclic compounds. **(K4)**
- CO5:** Evaluate the factors influencing spontaneity, colloidal stability, stereoisomerism, and qualitative chemical separations. **(K5)**
- CO6:** Design systematic approaches for identifying chemical species and interpreting physicochemical phenomena using fundamental chemical principles.

Unit I Thermodynamics

12 hrs

Introduction - Basic terminology and functional concepts(IKS)- System, boundary and surrounding- Types of systems: open, closed and isolated- Properties of a system: extensive and intensive - State of a system and state variables (or state functions)-Thermodynamic equilibrium - Process and types: Isothermal, adiabatic, isochoric, isobaric, cyclic, reversible, and irreversible- comparison between isothermal and adiabatic processes, reversible and irreversible processes - Internal energy as a state function- components of internal energy- Work: Thermodynamic concept-types of work - Heat : Thermodynamic concept- Heat(IKS) and work as path functions - First law of thermodynamics- Statement of the law of conservation of energy- Mathematical expression of the law- Application of the law- Heat capacity, specific heat capacity and molar heat capacity of a system- Relation between molar heat capacities of gases- Enthalpy and enthalpy change- Enthalpy as a state function- Relation between ΔH and ΔE - Enthalpies of reaction, formation and combustion-Definition and illustration- standard state- Calculation of enthalpy change using simple molecules. Hess law- Bond enthalpies and bond dissociation enthalpies-Definition and illustration using gas example (Numerical problems not expected)- Spontaneous (natural) process- Entropy-it's meaning of disorder- Gibb's free energy-its meaning as available energy- Criteria for spontaneity

Self-study: Ideal gas, ideal gas equation, homogeneous reactions and heterogeneous reactions, heat.

UNIT II Surface Chemistry and Colloidal Chemistry

12 hrs

Adsorption chemistry-introduction-definition-distinction from adsorption- Adsorption and adsorbate-definition and explanation- Types of colloidal systems- Classification of colloids(IKS)-Lyophilic and lyophobic sols-a comparison- Stability of colloids-origin of charge- electrical double layer-salvation- Electrical properties-electrophoresis and electro-

osmosis- Gels- gelation-classification-properties of gels-hydration, swelling or inhibition, syneresis and thixotropy- Emulsions-types of emulsion-identification of emulsion-dilution test, dye test, spreading test, viscosity and electrical conductivity-de-emulsification- Application of colloids in food, medicine, industry, purification of water, artificial rain, blue colour of the sky and cleaning action of soap.

Self-study: Adsorbent, adsorbate, molecular interactions.

UNIT III Carbohydrates, Alkaloids and Terpenoids

12 hrs

Introduction- Monosaccharide(IKS)- Reaction of glucose- Open chain structure and ring structure of glucose (elucidation not expected)- Epimers, mutarotation- Interconversion of glucose into fructose and vice versa- Disaccharides- Reactions and structure of sucrose (elucidation not expected)- Structure of maltose and lactose (elucidation not expected)- Polysaccharide- Starch- amylase and amyl pectin-type of glycosidic linkage- Reaction of starch- action of heat-, hydrolysis and with iodine- Alkaloids- Definition, classification, (based on structure) occurrence and extraction- General methods of identification-functional nature of oxygen-functional nature of nitrogen-unsaturation-exhaustive methylation- Structure of coniine- Terpenoids- Introduction, classification of terpenoids-Isoprene rule- Structure of citral (synthesis not included)

Self-study: Examples for food contains carbohydrates

UNIT IV Stereoisomerism and Heterocyclic Compounds

12 hrs

Optical isomerism- Plane polarized light - Optical activity - Asymmetric carbon- chirality - Elements of symmetry-plane of symmetry- axis of symmetry-centre of symmetry-dissymmetric- Van't Hoff-le Bel theory- Optical isomerism of tartaric acid- Racemization - Resolution of racemic-mixture-biochemical method, chemical method and chromatographic method- Geometrical isomerism- Cause for geometrical isomerism- Illustration of compounds containing C-C double bond - Heterocyclic compound(IKS)s- Pyrrole- Introduction- aromatic character- Basic and acidic character of pyrrole- Pyridine- Electronic interpretation of electron-rich centres- Reaction of pyridine- Quinoline- Skraup synthesis - Reactions of quinoline

Self-study: Isomers, cyclic compounds, practice to draw the structure of simple molecules like H_2O , NH_3 etc.

UNIT V Analytical Chemistry-II

12 hrs

Types of reactions relevant to qualitative analysis - Displacement reaction - Decomposition - Double decomposition- Hydrolysis- redox reaction- Complex formation- Interfering anions and their elimination- Group reagents and analytical group classification- Explanation and application of the following principles in qualitative analysis- Solubility and solubility product- Common ion effect- pH- Buffer.

Self-study: Anions, cations, saturated solution, unsaturated solution, oxidation and reduction

Note: Course materials will be supplied to the students.

CHEMISTRY PRACTICAL FOR BIOLOGICAL SCIENCES-II
(For BOT and ZOO)

Inorganic quantitative analysis-Subject code: 26UCHE22

SEMESTER II	EC- P2	CREDITS – 2	H/W=2
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Course outcomes

On completion of the course, the students will be able to

CO1: Recall the principles, reagents, and characteristic tests used in qualitative inorganic salt analysis. **(K1)**

CO2: Explain the reactions involved in the identification of common anions and cations. **(K2)**

CO3: Apply systematic analytical procedures to detect and identify anions and cations in simple salts. **(K3)**

CO4: Analyze experimental observations to distinguish between different ionic species. **(K4)**

CO5: Evaluate the accuracy of analytical results through confirmatory tests and logical interpretation. **(K5)**

CO6: Design a systematic scheme for the qualitative analysis and identification of unknown inorganic salts. **(K6)**

Qualitative analysis of a simple salt containing one anion and one cation

Anions : Carbonate, Borate, Fluoride, Oxalate and Phosphate

Cations : Lead, Bismuth, Copper, Cadmium, Cobalt, Nickel, Manganese, Zinc, Barium, Strontium and Ammonium

Note: Laboratory manual is supplied.

ALLIED CHEMISTRY- I (FOR PHYSICS) SUBJECT CODE: 26UCHE31

Semester: III	EC-T3	Credit: 3	Hours/W : 4
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Course Outcomes (COs):

On completion of the course, the students should be able to

- CO1:** Recall and describe fundamental concepts of atomic structure, periodic classification of elements and acid–base theories (K1)
- CO2:** Explain the principles of chemical bonding, bonding theories and periodic trends in atomic structure and predict bond order (K2)
- CO3:** Apply theoretical principles to determine electronic configurations and calculate oxidation numbers (K1, K2, K3)
- CO4:** Analyze trends in atomic properties, bonding characteristics, thermodynamic functions and interpret Born–Haber cycles, lattice energy, and equilibrium relationships (K4)
- CO5:** Evaluate the fundamental concepts of qualitative analysis inorganic compounds (K5)
- CO6:** Demonstrate systematic qualitative analysis of cations and anions, ensuring proper laboratory techniques, hazard management, waste disposal practices, and adherence to laboratory safety protocols (K6)

UNIT I Atomic Structure and Periodic Table

12 Hrs

Bohr model of atom- Atomic spectrum of hydrogen and Bohr theory - Refinement of the Bohr theory- Dual nature of electrons particles or waves- Quantum numbers and its significance- Uncertainty principle- Paul's exclusion principle, Hund's rule- Periodic table(IKS)- Modern periodic table- Long form of periodic table- Division of elements into s, p, d and f blocks-Bohr's aufbau principle electronic configuration of ground state of atoms up to K(Z=19)-Trends in atomic properties Ionization energy, successive ionization energy , electron affinity, electro negativity Pauling, Mulliken and Allred Rochow's scale

Self-study: Fundamentals of atomic structure, atomic number, mass number

UNIT II Structural and Chemical Bonding

12 hrs

Types of chemical bond - Electrovalent bond (conditions for formation and associated properties)- Covalent bond (conditions for formation and associated properties)- Coordinate covalent bond- Orbital overlap ss, sp, pp overlap- Sigma and pi bond formation of N₂ and O₂ properties- Polar and non-polar molecules- Dipole moment and its applications(IKS)- VSPER theory application to CH₄, NH₃ and H₂O - Molecular orbital theory, bonding, antibonding and non-bonding orbitals- MO diagrams for H₂ , He₂ , N₂ and O₂ bond order.

Self-study: Ionic bond, covalent bond, Coordinate bond

UNIT III Solid State and Energetics

12 hrs

Macroscopic properties of solids- Types of characteristics of crystals- Covalent solids structure and

properties of diamond and graphite- Ionic crystals solid NaCl- Metallic crystals- Molecular crystals intermolecular forces- Metals - free electron theory and band theory of metallic bond- Superconductors- Lattice energy- Born Haber cycle- Law of conservation of energy- Enthalpy of reactions- Entropy and Gibbs energy- Relationship between Gibbs energy and equilibrium.

Self-Study: Difference between crystalline and amorphous substances

UNIT IV Acids, Bases and Redox Processes

12 hrs

Concept of acids and bases(IKS)- Arrhenius concept- Bronsted Lowry concept conjugate acids and bases- Lewis concept- Effect of solvents and substituents on relative strengths of acids and bases- Hydrolysis- Ionization of water- pH scale definition of pOH , pK_a , pK_b simple numerical problem- Buffer solution - Redox processes- Electronic concept of oxidation and reduction- Oxidation number rules- Calculation of oxidation number of elements in neutral molecules and in ions- Balancing ionic equation by oxidation number method.

Self-Study: Ideas on acids, bases and salts

UNIT V Practical Chemistry-I: Qualitative Analysis

12 hrs

Introduction acquaintance with chemical laboratory equipment's solid reagents, liquid reagents and test papers laboratory instructions and some don'ts Bunsen burner (self-study) -Chemistry involved in the analysis of anion and cations - Dry tests (action of heat, flame test, filter ash test) -Wet test (with acids , with Na_2CO_3 extract)- Elimination of interfering anions and preparation of original solutions-Classification of cations into analytical groups- Condition for precipitation, application of solubility product and common ion effect in qualitative analysis- Safety in laboratory- General safety measures (safety equipment, safety notices, personal protection, dangers to avoid)- Chemical hazards (corrosive, irritant substances, toxic compounds, flammable explosives)- Physical hazards (fire, pressure) fire extinguisher- Spillage and waste disposal- First aid (immediate assistance, burns, eye injuries, bleeding, toxic materials) first aid kit.

Self-Study: Simple salt analysis.

Note: Course materials will be supplied to the students

ALLIED CHEMISTRY PRACTICAL – I (FOR PHYSICS)

Inorganic qualitative analysis

(Subject Code: 26UCHE32)

Semester: III	EC-P4	Credit: 2	Hours/W : 2
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Course outcomes:

On completion of the course, the students will be able to

CO 1: Explain and demonstrate the techniques of elimination of interfering radicals (K2)

CO 2: Apply the physical and chemical properties of various ions in the identification of unknown samples (K3)

CO 3 : Categorize the metal ions into different groups. (K3)

CO 4 : Identify the presence of inorganic salts in biological samples. (K4)

CO 5 : Separate ions using common ion effect and solubility product (K5)

CO 6 : Analyze samples using microscale techniques (K4)

ANIONS: Carbonate, Borate, Fluoride, Oxalate and Phosphate

CATIONS: Lead, Bismuth, Copper, Cadmium, Cobalt, Nickel, Manganese, Zinc, Barium, Strontium and Ammonium

Note: Laboratory manual is supplied

ALLIED CHEMISTRY- II (FOR PHYSICS)

SUBJECT CODE: 26UCHE41

Semester: IV	EC-T4 Credits : 3	Hours / W : 3
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Course Outcomes (COs)

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

- CO1:** Recall the fundamental concepts of hybridization (sp , sp^2 , sp^3), isomerism electrochemical cells, molecular properties, secondary bonding interactions, energy materials and principles of volumetric analysis. (K1, K2)
- CO2:** Explain and apply the principles and the laws governing electrochemistry and titration methodologies (K2)
- CO3:** Apply the principles hybridization, relationship between molecular properties, electrochemistry and volumetric analysis (K3)
- CO4:** Analyse Optical activity, differences between different energy materials, trends in molecular properties and potentiometric titrations (K4)
- CO5:** Evaluate the suitability of materials for energy harvesting and storage, the applications of volumetric titrations (K5)
- CO6:** Demonstrate volumetric analysis, Electrochemical cell setups and potentiometric titration systems, selection of suitable renewable energy materials (K6)

UNIT I Fundamentals of Organic Chemistry

9 hrs

Hybridization- Need for the concept of hybridization- sp , sp^2 and sp^3 hybridization with suitable examples- Isomerism in organic compounds- Structural isomerism types with example- Stereoisomerism conformational, geometrical and optical isomerism- Geometrical isomerism cis and trans nomenclature- Optical isomerism (IKS) elemental of symmetry chirality optical activity, enantiomers, diastereomers, mesomer and racemic mixture optical activity exhibited by lactic acid and tartaric acid.

Self-study: Fundamentals of isomerism and hybridization.

UNIT II Bonding and water treatment

9 hrs

Coordinate bonding with example. Pauling's theory – Postulates - Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$. Metallic bonding: Free electron theory and band theory. Water treatment methods: Ion exchange, electro dialysis and reverse osmosis (IKS). Dipole moment- o, p- Nitrophenol. Hydrogen bonding-types and applications-Van der Waal's forces. Colligative properties - K_b , K_f . Rast method.

Self-study: Non-bonding (Secondary bonding) interactions

UNIT III Electrochemistry

9 hrs

Introduction- Requirements of an electrochemical change- Electrochemical cells difference between electrolytic and galvanic cells- Salt bridge- Electrode potential and standard electrode potential- Electrochemical series and applications- Conventions used in electrode representation and in cell representation- Types of electrodes description of hydrogen, calomel and glass electrodes Nernst equation- Weston cadmium cell- Experimental determination of a cell emf and determination of electrode potential simple calculation- Potentiometric titrations and their advantages principle and method of acid base, redox and precipitation titrations- Determination of pH(IKS) using hydrogen, glass and quinhydrone electrodes

Self-study: Electrolysis and galvanic cells

UNIT IV Energy Materials

9 hrs

Primary Cells, Secondary cells, Dry Cells, Rechargeable batteries. Materials used – applications - Li-ion battery - Ni-MH battery. Fuel cells, Materials used in fuel cells. Photovoltaic effect- principle of solar energy conversion into electricity. Dye sensitized solar cells. Hydrogen production methods. Hydrogen storage materials – Metal-organic frameworks (MOFs). Conducting polymers and super conductors.

Self-study: Renewable energy

UNIT V Practical Chemistry II- Volumetry

9 hrs

Introduction definition of various terms (titrations, volumetric analysis, titrant indicator (IKS), end point requirements of the reaction selected for the titration common types of titrations. Law of equivalence equivalent weight of acids, bases, oxidizing agents, reducing agents and salts calculation of molecular weights and equivalent weights. Requirements of a primary standard - Secondary standards- Numerical problems in the preparation of solutions- Law of normalities preparation of HCl, H₂SO₄, HNO₃ (approximately 0.1N) from standard acids- Principles behind - Acid base titration - pH verses volume curves, choice of indicators form different acid base titrations- Permanganimetry- Dichrometry-diphenylamine and potassium ferricyanide as indicators- Iodimetry Preparation of iodine and starch solutions - starch as indicators- Iodometry- Role of KMnO₄ and K₂Cr₂O₇.

Self-study: Preparation of solution at different concentration

Note: Course materials will be supplied to the students

ALLIED CHEMISTRY PRACTICAL – II (FOR PHYSICS)
Inorganic Quantitative Analysis (Subject Code: 26UCHE42)

Semester: IV EC-P4 Credit: 2 Hours/W: 2
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Course outcomes:

On completion of the course, the students will be able to

CO1: Recall the basic principles of Volumetric Analysis (K2)

CO2: Explain the types of reactions behind titrimetric methods and the role of Indicators (K1, K2)

CO3: Apply the laws of volumetric titrations to calculate the quantity of the substance present in the given solution (K3)

CO4: Analyse the quantitatively the given substance using the principles for neutralization and redox reactions (K3)

CO5: Demonstrate the choice of titration pair and indicators for acid-base titrations and redox titrations (K5, K6)

CO 6: Design titrations by choosing suitable the titration pair, indicators and experimental conditions and carry out the quantitative analysis (K4)

S. No	Estimation	Link	Standard
1	Strong Acid	Weak Base/Strong Base	Strong Base
2	Strong Acid	Strong Base	Weak Acid
3	Strong Base	Strong Acid	Weak Base
4	Oxalic acid	Potassium Permanganate	Oxalic acid
5	Ferrous Sulphate	Potassium Permanganate	Ferrous Ammonium Sulphate
6	Potassium dichromate	Ferrous Sulphate	Potassium dichromate
7	Ferrous Ammonium Sulphate	Potassium dichromate	Ferrous Sulphate
8	Potassium Permanganate	Sodium thiosulphate	Potassium dichromate
	Magnesium Sulphate	EDTA	Zinc Sulphate
10	Zinc Sulphate	EDTA	Magnesium Sulphate

Note: Laboratory manual will be supplied