TAKSHASHILA UNIVERSITY

(Tamil Nadu State Private University)

ONGUR, TINDIVANAM TK, VILLUPURAM DT

FACULTY OF SCIENCES

SCHOOL OF BASIC SCIENCES

Department of Chemistry

REGULATION 2024

CURRICULUM & SYLLABI

V Semester UG

VISION AND MISSION OF UNIVERSITY

VISION:

To inspire, develop and create change makers and world leaders of tomorrow through knowledge similar to the ancient Takshashila University

MISSION:

Nurturing and developing the leaders of tomorrow with the brightest minds and best resources, fostering lifelong and ethical excellence.

DEPARTMENT VISION AND MISSION

VISION:

- To be a center of excellence in fundamental sciences through innovative teaching and research.
- To nurture scientific curiosity and critical thinking among students.
- To contribute to societal development through scientific knowledge and discovery.

MISSION:

M1: Academic Excellence and Skill Development	To provide high-quality chemistry education that integrates fundamental knowledge, advanced scientific concepts, and hands-on laboratory training to prepare students for academic, industrial, and research careers
M2: Research, Innovation, and Interdisciplinary Collaboration	To promote cutting-edge research, innovation, and interdisciplinary collaboration in emerging areas of chemical sciences, nanotechnology, materials science, environmental sustainability, and healthcare
M3: Professional Competency, Ethics, and Leadership	To develop professionally competent graduates with critical thinking, leadership, communication skills, ethical values, and a commitment to lifelong learning and societal development
M4: Industry Engagement and Sustainable Development	To strengthen industry–academia partnerships, entrepreneurship, and sustainable scientific practices that address global challenges and contribute to technological and socioeconomic progress

PROGRAMME OUTCOMES (POs)

PO1: Disciplinary Knowledge
Demonstrate comprehensive knowledge of the fundamental principles and advanced concepts of chemistry, including organic, inorganic, physical, and analytical chemistry.

PO2: Analytical and Critical Thinking
Develop the ability to analyze chemical data, evaluate scientific evidence, interpret experimental results, and apply critical thinking to draw conclusions and make informed decisions.

PO3: Problem Solving
Identify, formulate, and solve theoretical and practical chemical problems using scientific methods, quantitative reasoning, and appropriate experimental techniques.

PO4: Effective Communication
Communicate scientific ideas, experimental findings, and research outcomes effectively through oral presentations, laboratory reports, and digital communication while maintaining scientific accuracy.

PO5: Modern Tool Usage
Acquire proficiency in the use of modern laboratory instruments, analytical techniques, computational tools, information technology, and safety practices relevant to chemistry and scientific research.

PO6: Ethics and Values
Demonstrate professional ethics, environmental responsibility, laboratory safety awareness, academic integrity, and a commitment to sustainable development in scientific practice.

PO7: Teamwork and Leadership
Work effectively as an individual and as a member or leader of multidisciplinary teams, demonstrating collaboration, responsibility, leadership qualities, and interpersonal skills to achieve common goals.

PROGRAMEDUCATIONAL OBJECTIVES (PEOs)

PEO1: Professional Knowledge

Apply contemporary chemical knowledge and emerging technologies to address challenges in research, industry, healthcare, energy, and environmental sustainability.

PEO2: Research and Development

Apply advanced chemical principles, experimental techniques, and analytical skills to investigate scientific problems and contribute to research and innovation in chemistry and nanotechnology.

PEO3: Leadership

Demonstrate leadership, teamwork, and effective communication skills in planning, executing, and managing scientific and laboratory-based activities.

PEO4: Professional Ethics

Graduates will practice ethical values, environmental awareness, teamwork, and effective communication while contributing responsibly to society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Domain Knowledge

Demonstrate a thorough understanding of the fundamental concepts of organic, inorganic, physical, analytical, industrial and environmental chemistry.

PSO2: Professional Competency

Practice ethical conduct, laboratory safety, environmental responsibility, and integrity in scientific research and professional activities.

TAKSHASHILA UNIVERSITY
(Established under Tamil Nadu State Private Universities Act 2019 & Recognized by UGC u/s 2(f) of the UGC Act,1956)

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FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY (B.Sc.CHEMISTRY)

(REGULATION 2024)

SEMESTER – V

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Hrs.	Max. Marks								
				L	T	P			CAT I, II, III (Best of Two)	ASS	MCQ	ATT	SEM	PRA	CAM	ESM	Total
1	U24CHB501	Organic Synthesis – I	DSC	3	0	2	4	75	20	5	5	5	5	50	40	60	150
2	U24CHB502	Organometallics and Coordination Chemistry	DSC	3	0	2	4	75	20	5	5	5	5	50	40	60	150
3	U24CHT503	Electrochemistry	DSC	3	1	0	4	60	20	5	5	5	5	-	40	60	100
4	U24CHT504	Analytical Chemistry	DSC	3	1	0	4	60	20	5	5	5	5	-	40	60	100
5	U24CHT505	Pharmaceutical Chemistry	DSE	3	0	0	3	45	20	5	5	5	5	-	40	60	100
						Total:	19										
6	U24***5**	Generic Elective - III	GE	2	0	0	2	30	-	-	-	-	-	-	100	-	100
7	U24BAT568	Fundamentals of Management	SEC	2	0	0	2	30	-	-	-	-	-	-	100	-	100
8	U24UMP592	Foreign Language -I	FL	1	0	0	1	15	-	-	-	-	-	-	100	-	100
9	U24UMP593	Green Credit - V	GC	0	0	2	1	15	-	-	-	-	-	-	100	-	100
						Total:	6										
						Total:	25	405						100	600	300	1000

Note:

L – Lecture
T – Tutorial
P – Practical
ASS – Assignment
CAM– Continuous Assessment Marks
CAT – Continuous Assessment Test
ATT– Attendance
SEM – Seminar
ESM – End Semester Exam Mark

K.V
BoS Chairman

U24CHB501	Organic Synthesis –I	L	T	P	C	Total
		3	0	2	4	75

COURSE OBJECTIVES:

• To learn the synthesis, properties, and reactions of oxygen-containing functional groups
• To understand the preparation, reactivity, and importance of nitrogen-containing functional groups
• To develop knowledge in carbon–carbon, carbon–nitrogen, carbon–oxygen, and carbon–sulfur bond-forming reactions in organic synthesis
• To analyze reagents, and applications of oxidation reactions in organic chemistry
• To evaluate the mechanisms of reduction reactions and reducing agents in organic synthesis

COURSEOUTCOMES:

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

CO1 :	Explain the chemistry and synthetic applications of oxygen-containing functional groups.
CO2 :	Analyze the preparation and reactions of nitrogen-containing functional groups.
CO3 :	Apply bond-forming reactions for the synthesis of organic molecules.
CO4 :	Select suitable oxidation methods for functional group transformations.
CO5 :	Apply appropriate reduction techniques in the synthesis of organic compounds.

UNIT I:OXYGEN FUNCTIONAL GROUPS	**9 Hrs.**
Carbonyl compounds - aldehydes and ketones – enolates– Active methylene compounds- synthesis and application of ethyl acetoacetate, diethyl malonate and cyanoaceto esters. Mono, di- and unsaturated carboxylic acids – preparation and reactions– Carboxylic acid derivatives – preparation and reaction of acid chlorides, anhydrides, amides, esters– Hemiacetal, hemiketal, acetal, orthoester, epoxides - preparation and reactions.	

UNIT II :NITROGEN FUNCTIONAL GROUPS	**9 Hrs.**
Amino compounds – nomenclature and classification –Carbylamine reaction, diazotization – comparison of aliphatic and aromatic amines –Reductive amination of aldehydic and ketonic compounds– Amidine,	

azide, azo, diazoalkanes, cyanates, nitrile, nitrite, oxime, carbamate ester, nitro compounds, and diazonium salts – preparation and reactions.

UNIT III :C-C, C-N, AND C-O/S BOND FORMATION	9 Hrs.

C-C bond formation – aldol, Arndt-Eistert, Bardhan-Sengupta, Baker-Venkataraman, Barbier, BaylisHillman, Benzoin, Dieckmann, Friedel–Crafts, Michael, Perkin, Claisen, Robinson annulations, Vilsmeier, Wittig, Knoevenagel, and Ullmann Reactions– C-N bond formation – Mannich, Mitsunobu, Ritter, Gabriel, Ugi, Doebner, Buchwald-Hartwig, and Stork enamine reactions– Formation of azides and hydrazines– C-O and C-S bond formation –Fischer esterification, Barton, Prins, and Darzen,

UNIT IV :OXIDATION	9 Hrs.

Alcohols to carbonyl compounds - chromium(VI) oxidants, dimethyl sulfoxide - Swern oxidation, manganese(IV) oxide, silver carbonate, hypervalent iodine(III) and (V) reagents, ceric ammonium nitrate (CAN), N-oxyl radical– Alkenes to epoxides by H_2O_2, hydroperoxides and peroxyacids– Prevost oxidation and Woodward modifications– Oxidative cleavage of 1,2-diols - periodic acid– Oxidation of allylic and benzylic C-H bonds - NBS, chloranil-T, and TEMPO– Oppenauer and Corey-Kim oxidation.

UNIT V : REDUCTION	9 Hrs.

Catalytic hydrogenation – homogeneous and heterogeneous catalytic reductions– Dissolving metal reductions– Non-metallic reductions – Wolff-Kishner, diimide reductions, and Hantzsch ester– Metal hydride reductions - Nucleophilic metal hydrides, DIBAL-H and Red-Al– Electrophilic metal hydrides - BH_3 and AlH_3 - Hydrogenolysis - use of tri-n-butyl tin hydride

Total Hours: 45

List of Experiments:

1. Purification of liquids: Simple & fractional distillation methods

2. Purification of solids: Sublimation& recrystallization (benzoic acid, salicylic acid etc.)

3. Separation of a mixture of two components by solvent extraction.

4. Single step organic synthesis – Nitration, Bromination, Amination etc.

5. Determination of melting points of known and unknown compounds and the effect of impurities.

Total Hours: 30

TEXTBOOKS:	
1.	Jerry March, *Advanced Organic Chemistry: Reactions, Mechanisms and Structure*, 6th Edition, Wiley, New York, 2007
2.	Francis A. Carey and Richard J. Sundberg, *Advanced Organic Chemistry, Part A: Structure and Mechanisms*, 5th Edition, Springer, New York, 2007.
3.	Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), Ny, Allyn &Beecon Ltd., (1976).
4.	Francis A. Carey and Richard J. Sundberg, *Advanced Organic Chemistry, Part B: Reactions and Synthesis*, 5th Edition, Springer, New York, 2007.

REFERENCE BOOKS:	
1.	Robert T. Morrison and Robert N. Boyd, *Organic Chemistry*, 7th Edition, Pearson Education, New Delhi, 2011.
2.	Arun Bahl and B. S. Bahl, *Advanced Organic Chemistry*, S. Chand & Company Ltd., New Delhi, Latest Edition.
3.	Jonathan Clayden, Nick Greeves, and Stuart Warren, *Organic Chemistry*, 2nd Edition, Oxford University Press, 2012.
4.	Francis A. Carey and Richard J. Sundberg, *Advanced Organic Chemistry, Part A: Structure and Mechanisms*, 5th Edition, Springer, 2007.
5.	Jonathan Clayden, Nick Greeves, and Stuart Warren, *Organic Chemistry*, 2nd Edition, Oxford University Press, Oxford, 2012.

WEB REFERENCES:	
1.	https://www.youtube.com/watch?v=dRgYqsJgtmY
2.	https://www.youtube.com/watch?v=1ro0NR6zDlM
3.	https://www.organic-chemistry.org/namedreactions/
4.	http://www.digimat.in/nptel/courses/video/104101127/L42.html
5.	https://www.youtube.com/watch?v=1bSXMPSWCfM

BoS Chairman

U24CHB502	Organometallics and Coordination Chemistry	L	T	P	C	Total
		3	0	2	4	75

COURSE OBJECTIVES:

• To understand the concepts, structure, bonding, and electron-counting rules of organometallic compounds and metal carbonyls
• To understand molecular orbital concepts, fragment molecular orbitals, and bonding in organometallic compounds
• To understand the principles and applications of organometallic catalysts in homogeneous and heterogeneous catalysis
• To understand the bonding theories and stereochemistry of coordination compounds
• To understand the spectral and magnetic properties of coordination complexes using ligand field theory and related concepts

COURSE OUTCOMES:

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

CO1 :	Explain the structure, bonding, and electron-counting principles of organometallic compounds and metal carbonyls.
CO2 :	Interpret molecular orbital diagrams and apply the isolobal concept to organometallic systems.
CO3 :	Analyze organometallic catalytic reactions and their industrial applications.
CO4 :	Apply coordination theories to explain the structure, bonding, and properties of transition metal complexes.
CO5 :	Interpret the electronic spectra and magnetic properties of coordination compounds using ligand field theory and spectroscopic parameters.

UNIT I :CONCEPTS AND METAL CARBONYLS	**9 Hrs.**
History and overview of organometallic compounds– Classification and nomenclature, classes of ligands, hapticity– 18-electron and 16-electron organometallic compounds– Metal carbonyls – synthesis and bonding, donor and acceptor properties of CO, binding modes of CO, polynuclear carbonyls, metal-metal bonding in M-CO clusters– Cluster valence electron (CVE) count – Wade-Mingos' rule, capping	

rule, Mingos' rule – CVE based structure prediction– IR spectral features of metal carbonyls– Reactions and activation of metal carbonyls– Metal nitrosyl (M-NO) compounds – bonding and structural features – comparison with metal carbonyl.

UNIT II :STRUCTURE AND BONDING IN ORGANOMETALLIC COMPOUNDS	9 Hrs.

Fragment molecular orbitals (FMO) of various organic and inorganic moieties like CH_3, CH_2, CH, BH_2, BH, NH_2 and NH– Walsh's diagram of hetero di and triatomic molecule– Inorganic fragments MLn with varying number of L – Symmetry and shape of their FMO's– Isolobal concept, isoelectronic and isolobal relationships between various organic and inorganic fragments– Structure and bonding between various organic and inorganic fragments based on MO level diagrams.

UNIT III :APPLICATIONS OF ORGANOMETALLICS	9 Hrs.

Homogeneous and heterogeneous organometallic catalysis - principle, mechanism and their applications– Alkene hydrogenation using Wilkinson's catalyst, water-gas shift reaction, Monsanto process and Cativa Process– Hydro-formylation reactions, Wacker process, Ziegler-Natta polymerization of alkenes.

UNIT IV :THEORIES AND CONCEPTS ON D-BLOCK COORDINATION COMPOUNDS	9 Hrs.

Werner's coordination theory, valence bond theory (VBT), crystal field theory (CFT) – CFSE – effects of CFSE, types of ligands– Spectrochemical series, spectral and magnetic properties, and nephelauxetic effect– Crystal field splitting - Oh, Td, and square planar – factors affecting the magnitude of CFSE, isomerism in coordination complexes, Jahn-Teller (JT) distortion – manifestation on spectral properties– Limitations of CFT– Molecular orbital theory and ligand field theory.

UNIT V: SPECTRAL AND MAGNETIC PROPERTIES	9 Hrs.

Russell-Saunders coupling schemes, term symbols for various d n ions, Orgel diagrams for d^n systems, ligand field parameters, Dq, Racah parameter B and nephelauxetic constant. Tanabe-Sugano diagrams – applications. Charge-transfer transitions – MLCT and LMCT– Selection rules - spin-orbit and vibronic coupling effects– Magnetic properties of coordination complexes – magnetic susceptibility – the contribution of spin-orbit coupling on μeff, types of magnetic behaviour - para, ferro, anti-ferro and ferri-magnetic systems– Curie and Curie-Weiss laws–Guoy, Faraday and SQUID methods– Kotani plots.

Total Hours: 45

List of Experiments:

Quantitative Analysis: Preparation of the following inorganic complexes.

1) Tetraammine Cu(II) sulphate.
2) Hexaammine Ni(II) chloride.
3) Tris (ethylene diamine) Ni(II) thiosulphate.
4) Mercury tetra thiocyanato cobaltate(II).
5) Potassium tri oxalate chromate(III).

Total Hours: 30

TEXTBOOKS:	
1.	Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr, Inorganic Chemistry, 5th Edition, Pearson Education, 2014.
2.	Robert H. Crabtree, The Organometallic Chemistry of the Transition Metals, 7th Edition, John Wiley & Sons, Hoboken, 2019.
3.	Elschen Broclawik, Tadeusz Borowiecki, and Jacek R. Kłabunowski (Eds.), Organometallic Chemistry: Fundamentals and Applications, CRC Press, 2022.
4.	Puri B.R., Sharma L.R., Kalia K.K. Principles of Inorganic chemistry, (33rd edition), New Delhi, Shoban Lal Nagin Chand.Co, 2020.

REFERENCE BOOKS:	
1.	Catherine E. Housecroft and Alan G. Sharpe, *Inorganic Chemistry*, 5th Edition, Pearson Education Limited, Harlow, 2018.
2.	Robert H. Crabtree, *The Organometallic Chemistry of the Transition Metals*, 7th Edition, John Wiley & Sons, Hoboken, 2019
3.	Christoph Elschenbroich, *Organometallics*, 3rd Edition, Wiley-VCH, Weinheim, 2006.
4.	Lee, J. D., *Concise Inorganic Chemistry*, 5th Edition, Wiley India Pvt. Ltd., New Delhi, 2008.
5.	Huheey, J. E., Keiter, E. A., Keiter, R. L., and Medhi, O. K., Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edition, Pearson Education, New Delhi, 2006.

WEB REFERENCES:	
1.	https://www.youtube.com/watch?v=etxRR08x7x8
2.	https://www.youtube.com/watch?v=Juu799Pmxl4&list=PLj_Alq7xw30ncr8OH-LwVGZFeZJSJiGHh
3.	https://www.youtube.com/watch?v=WVKp8vOCbzI&list=PLj_Alq7xw30ncr8OH-LwVGZFeZJSJiGHh&index=60
4.	https://www.youtube.com/watch?v=BZ_tY88o0oI&list=PLbMVogVj5nJTWU1tCPCtLBaiWNsJRAiZZ
5.	https://www.youtube.com/watch?v=_eak-XY3Vx8

BoS Chairman

U24CHT503	Electrochemistry	L	T	P	C	Total
		3	1	0	4	60

COURSE OBJECTIVES:

• To learn the fundamental principles of quantitative electrochemistry, ionic conductance, electrolyte behavior, and mass transport phenomena
• To understand electrochemical cells, electrode potentials, electrified interfaces, and electrochemical measurement techniques.
• To analyze the kinetics and mechanisms of electrode reactions and the theoretical basis of electrochemical processes
• To demonstrate the principles, instrumentation, and applications of modern electroanalytical techniques
• To evaluate electrochemical energy storage systems, fuel cells, industrial electrochemical processes, and advanced electrochemical technologies

COURSE OUTCOMES:

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

CO1 :	Explain the principles of quantitative electrochemistry, electrolyte conductance, and ionic transport.
CO2 :	Analyze electrochemical cells, electrode interfaces, and potential measurement techniques.
CO3 :	Interpret the kinetics and mechanisms of electrochemical reactions using appropriate theoretical models.
CO4 :	Apply electroanalytical techniques for the characterization of electrochemical systems.
CO5 :	Evaluate electrochemical energy storage devices and industrial electrochemical processes for practical applications.

UNIT I :QUANTITATIVE ELECTROCHEMISTRY AND IONICS	**12 Hrs.**
Quantitative electrochemistry – review of Faraday's laws– Conductivity of electrolytes, Kohlrausch law, solubility product and salt hydrolysis– Debye-Huckel-Onsager equation – Debye-Huckel limiting law and its testing and improvement – conductometric titrations– Aqueous and non-aqueous electrolytes– Mass transfer in electrolytes – convection, diffusion and migration, general mass transfer equation – Nernst-Planck equation effect of supporting electrolytes, microscopic view of diffusion, Ficks law, boundary conditions.	

K.V

UNIT II :ELECTRIFIED INTERFACES	12 Hrs.

Electrochemical cells – cell resistance, standard electrode potentials, reversibility, calculation of emf – variation of potential with concentration, pressure and temperature– Interfacial region – electrical double layers and their structure– Polarizable and nonpolarizable electrodes– Electrochemical potentials – properties – applications– Liquid junction potential – calculation – minimization. Applications of potential measurements, reference electrodes, ion-selective electrodes, potentiometry, pH metry.

UNIT III :KINETICS OF ELECTROCHEMICAL REACTIONS	12 Hrs.

Transition state theory, essentials of electrode reactions, Butler-Volmer model, one step-one electron processes, transfer coefficient, exchange current, current over potential equation, Tafel plots, effects of mass transfer, multistep mechanisms, quasi reversible and irreversible processes, microscopic theories of charge transfer– Marcus model, distribution of energy states model, tunnelling and extended charge transfer– Faradaic and nonfaradaic processes, electrode reactions with coupled homogeneous chemical reactions. Theory for voltametric and chronopotentiometric methods.

UNIT IV :ELECTROANALYTICAL TECHNIQUES	12 Hrs.

Potential sweep methods – linear sweep voltammetry and cyclic voltammetry – reversible, quasireversible and irreversible systems. Potential step methods – chronoamperometry, polarographyDME-Ilkovic equation, pulse voltammetry – normal and differential pulse. Electrochemical impedance spectroscopy – Bode and Nyquist plots.

UNIT V - ELECTROCHEMICAL ENERGY STORAGE DEVICES AND PROCESSES	12 Hrs.

Electrochemical energy storage: principles of operation of supercapacitors and batteries– Primary batteries, metal-air and lithium primary batteries– Secondary batteries - lead acid, lithium-ion and lithium polymer batteries– Fuel cells - PEMFC, direct methanol fuel cells– Industrial cathodic processes – electrodeposition of copper, nickel, zinc and chromium over mild steel– Industrial anodic processes – anodising of aluminium, electropolishing –electrochemical machining– Electrodes deposition.

Total Hours: 60

TEXTBOOKS :

1.	John O'M. Bockris, Amulya K. N. Reddy, and Maria Gamboa-Aldeco, Modern Electrochemistry, Volume 2B: Electrodics in Chemistry, Engineering, Biology and Environmental Science, 2nd Edition, Springer, New York, 2002.
2.	Allen J. Bard and Larry R. Faulkner, Electrochemical Methods: Fundamentals and Applications, 2nd Edition, John Wiley & Sons, New York, 2001.
3	D.R.Crow "Principles and Applications of Electrochemistry" S. Thomes, 4th edition, 1988.

REFERENCE BOOKS :	
1.	Allen J. Bard, Larry R. Faulkner, and Henry S. White, *Electrochemical Methods: Fundamentals and Applications*, 3rd Edition, John Wiley & Sons, Hoboken, 2022.
2.	John O'M. Bockris and Amulya K. N. Reddy, *Modern Electrochemistry, Volume 1: Ionics*, 2nd Edition, Kluwer Academic/Plenum Publishers, New York, 2000.
3.	David A. J. Rand, Ralph Woods, Ronald M. Dell, James P. D. Jones, Peter T. Moseley, Doron Garche, and Clive H. Vincent, *Batteries for Electric Vehicles: Materials and Electrochemistry*, Elsevier, Amsterdam, 2018.
4.	Christopher M A, Brett, 'Electrochemistry – Principles, Methods and Applications', Oxford University, (2004).
5.	Pletcher, D. and Walsh, F.C., 1990. Industrial electrochemistry. Springer Science & Business Media.

WEB REFERENCES :	
1.	https://www.youtube.com/watch?v=PTNNVUsr3a8
2.	https://www.youtube.com/watch?v=KGXgoXpbtXI
3.	https://www.youtube.com/watch?v=_NrGL-MbqQw&list=PLwdnzlV3ogoXWEOnSbG5CZFNUDy5G2dgn
4.	https://www.youtube.com/watch?v=c-wgTU5Zu8s&list=PLhWyf911na-Xu-50faKXWU_rH3vIxaryB

U24CHT504	Analytical Chemistry	L	T	P	C	Total
		3	1	0	4	60

COURSE OBJECTIVES:

• To study the principles of analytical chemistry, statistical data analysis, error evaluation, and sampling techniques
• To understand extraction methods, distillation techniques, and sample preparation procedures used in chemical analysis
• To demonstrate the principles, instrumentation, and applications of chromatographic separation techniques
• To evaluate the theory, instrumentation, and analytical applications of thermal analysis techniques
• To analyze the applications of advanced microscopic and surface characterization techniques

COURSE OUTCOMES:

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

CO1 :	Apply statistical methods to evaluate analytical data, errors, and sampling procedures.
CO2 :	Select appropriate extraction and distillation techniques for chemical separation and sample preparation.
CO3 :	yze chemical compounds using chromatographic techniques and interpret chromatographic data.
CO4 :	Interpret thermal analysis data for the characterization of materials and compounds.
CO5 :	Evaluate the morphology, composition, and surface characteristics of materials using advanced microscopy and spectroscopy.

UNIT I :ERRORS, STATISTICS, AND SAMPLING	**12 Hrs.**
Theoretical principles of qualitative and quantitative analysis– Types of analytical methods – importance of analytical methods in qualitative and quantitative analysis – chemical and instrumental methods – advantages and limitations– Data analysis – average deviation, standard deviation, confidence limits, comparison of results – t-test and f-test, rejection of results, calibration curves, and correlation coefficient– Significant figures– Sampling – procedures and statistics	
UNIT II :AQUEOUS AND SOLID PHASE EXTRACTION	**12 Hrs.**

Liquid-liquid extraction – theory and selection of solvents– Distillation – introduction, types of distillation, and applications– Solid phase extraction (SPE) – types, formats and apparatus, method of operation, solvent selection, factors affecting SPE, automation, and on-line SPE– Supercritical fluid extraction – instrumentation and applications.

UNIT III :CHROMATOGRAPHY	**12 Hrs.**

Thin layer chromatography – stationary phase, mobile phase, adsorbents, plate preparation, sample application, development, saturation of chamber, detection of spot, Rf values calculation, effect of adsorbent, solvent, solute, quantitative analysis and applications– Column chromatography – packing a column and application– Gas chromatography (GC), high-performance liquid chromatography (HPLC), GC-MS and LCMS – instrumentation, working principle and application.

UNIT IV: THERMAL ANALYSIS	**12 Hrs.**

Principle of thermogravimetry (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC) – instrumentation and characteristics of TGA and DTA curves, factors affecting TGA and DTA curves– Applications – determination of purity of compounds by DSC, thermometric titrations, microthermal analyser – working principle and applications.

UNIT V: SURFACE CHARACTERIZATION TECHNIQUES	**12 Hrs.**

Principle, instrumentation, working and applications of the following microscopic techniques– SEM, AFM, STM, STEM, TEM, confocal microscopy and fluorescence microscopy– Elemental composition – energy dispersive spectroscopy, UPS, XPS, Auger electron spectroscopy, selected area diffraction.

Total Hours: 60

TEXTBOOKS:

1.	Daniel C. Harris, *Quantitative Chemical Analysis*, 10th Edition, W. H. Freeman and Company, New York, 2020.
2.	Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, *Principles of Instrumental Analysis*, 7th Edition, Cengage Learning, Boston, 2018.
3.	Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, *Instrumental Analysis*, 8th Edition, Cengage Learning, Boston, 2021.

REFERENCE BOOKS:	
1.	Khandpur, R.S, *Handbook of Analytical Instruments*, 4th Edition, McGraw-Hill Education (India) Pvt. Ltd., New Delhi, 2020.
2.	D. A. Skoog, F. J. Holler, and S. R. Crouch, *Principles of Instrumental Analysis*, 7th Edition, Cengage Learning, Boston, 2018.
3.	Gary D. Christian, Purnendu K. Dasgupta, and Kevin A. Schug, *Analytical Chemistry*, 7th Edition, John Wiley & Sons, Hoboken, NJ, 2014.
4.	Skoog, D.A., Holler, F.J. and Nieman, T.A., Principles of instrumental analysis 5th edition. Saunders College Pub. Co.: Philadelphia, 1998.
5.	Skoog, D.A., West, D.M., Holler, F.J. and Crouch, S.R.,. Fundamentals of analytical chemistry. Cengage learning, 2013.

WEB REFERENCES:	
1.	https://www.youtube.com/watch?v=hoRRu9NdrGs
2.	https://www.youtube.com/watch?v=hj4uq29_qLw
3.	https://www.youtube.com/watch?v=wHKq2SdDZDk
4.	https://www.youtube.com/watch?v=OFh_Id8Ja4Y
5.	https://www.youtube.com/watch?v=7QhoFk1GczA

Open Elective Courses
(Offered in Semester V)

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Hrs.	Max. Marks		
				L	T	P			CAM	ESM	Total
1	U24CHT505	Pharmaceutical Chemistry	DSE	3	0	0	3	45	40	60	100
2	U24CHT506	Forensic Chemistry	DSE	3	0	0	3	45	40	60	100
3	U24CHT507	Green Chemistry	DSE	3	0	0	3	45	40	60	100
Semester Total:							**9**		**120**	**180**	**300**

U24CHT505	Pharmaceutical Chemistry	L	T	P	C	Total
		3	0	0	3	45

COURSE OBJECTIVES:

• To study the fundamentals of pharmaceutical chemistry and drug discovery
• To understand drug–target interactions and factors influencing drug action
• To demonstrate the thermodynamic principles involved in drug action
• To analyze the role of stereochemistry in drug design and activity
• To demonstrate the principles of drug metabolism and biotransformation

COURSE OUTCOMES:

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

CO1 :	Explain the fundamentals of pharmaceutical chemistry and drug development.
CO2 :	Analyze drug–target interactions and physicochemical properties affecting drug action.
CO3 :	Apply thermodynamic concepts to drug action.
CO4 :	Evaluate the influence of stereochemistry on drug activity.
CO5 :	Interpret drug metabolism and biotransformation pathways.

UNIT I :INTRODUCTION TO PHARMACEUTICAL CHEMISTRY	**9 Hrs.**
Introduction to Pharmaceuticals, Historical development, Classification drugs, Nomenclature of Pharmaceuticals– Drug discovery and development process, Sequence of events after drug administration, List of physicochemical properties related to drug action, Clinical Chemistry and the importance of fundamental chemistry concepts and analytical techniques.	

UNIT II :DRUG-TARGET INTERACTIONS	**9 Hrs.**
Structural Effects on Biological Action, Role and types of chemical bonding interactions between drug and target, binding of neurotransmitters to their receptors, Solubility, partition coefficient, dissociation constant, hydrogen bonding, ionization, drug shape, surface activity, complexation, protein binding, molar refractivity– Enzyme, receptors, nuclei acid, protein, lipid as drug targets.	

UNIT III:BASICS OF DRUG ACTION	9 Hrs.
Energy concept and its importance in drug action – First, Second, and Third laws of thermodynamics and the principles derived from these laws that are significant to drug action– Importance of chemical potential in drug action – Thermodynamic cycle –Statistical thermodynamics in predicting the structure of biomolecules and their interaction with drug molecules– Macromolecular vs. micromolecular correlation using thermodynamics	

UNIT IV :INFLUENCE OF STEREOCHEMISTRY ON DRUG ACTION	9 Hrs.
Stereoisomers, Stereochemistry of unsaturated compounds, Enantiomers, Diastereomers, Partition coefficients– Bioisosterism – stereochemical aspects of drug action, Realization that stereoselectivity is a pre-requisite for evolution; Role selective and specific therapeutic agents; Case studies; Enantioselectivity in drug absorption, metabolism, distribution and elimination.	

UNIT V - CHEMICAL ASPECTS OF DRUG METABOLISM	9 Hrs.
Introduction, Effects of chemical structure on Phase I oxidative, reductive, and hydrolytic reactions, Effects of chemical structure on phase II conjugative reactions (COMT and PNMT–catalyzed sulfation, glucuronidation, amino acid conjugation, mercapturic acid formation), Sites of metabolism, Metabolic pathways of selected common drugs, Metabolites identified for a new anticancer drug, Imatinib.	

Total Hours: 45

TEXT BOOKS :	
1.	Thomas L. Lemke, David A. Williams, Victoria F. Roche, and S. William Zito, Foye's Principles of Medicinal Chemistry, 8th Edition, Wolters Kluwer, Philadelphia, 2019.
2.	Graham L. Patrick, An Introduction to Medicinal Chemistry, 7th Edition, Oxford University Press, Oxford, 2023.
3.	David G. Watson, Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists, 4th Edition, Elsevier, London, 2020.

REFERENCE BOOKS :	
1.	Graham L. Patrick, *Medicinal Chemistry*, 2nd Edition, Oxford University Press, Oxford, 2017.
2.	Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Edited by John M. Beale Jr. and John H. Block, 13th Edition, Lippincott Williams & Wilkins, Philadelphia, 2011.

3.	Malcolm Rowland and Thomas N. Tozer, *Clinical Pharmacokinetics and Pharmacodynamics: Concepts and Applications*, 5th Edition, Wolters Kluwer, Philadelphia, 2019.
4.	Thomas Nogrady and Donald F. Weaver, Medicinal Chemistry: A Molecular and Biochemical Approach, 3rd Edition, Oxford University Press, Oxford, 2005.
5.	A. Kar, Medicinal Chemistry, 5th Edition, New Age International Publishers, New Delhi, 2018.

WEB REFERENCES :	
1.	https://www.youtube.com/watch?v=UHEXXGiegd0&list=PLyqSpQzTE6M9Q9Uo1gEp7B6bLbLFzv27F
2.	https://www.youtube.com/watch?v=1lShzHUpgms&list=PLyqSpQzTE6M9Q9Uo1gEp7B6bLbLFzv27F&index=43
3.	https://www.youtube.com/watch?v=hEUj-ZcxkcM
4.	https://www.youtube.com/watch?v=J85dMiz3J-o&list=PLyqSpQzTE6M9Q9Uo1gEp7B6bLbLFzv27F&index=38

U24CHT506	Forensic Chemistry	L	T	P	C	Total
		3	0	0	3	45

COURSE OBJECTIVES:

• To understand the fundamentals of forensic science and its ethical practices
• To learn crime scene investigation and evidence analysis techniques
• To analyze forensic drug and toxicology
• To study alcohol analysis and its forensic applications
• To apply chromatographic techniques in forensic investigations

COURSE OUTCOMES:

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

CO1 :	Explain the fundamentals and principles of forensic science.
CO2 :	Analyze crime scene evidence using forensic techniques.
CO3 :	Identify and interpret drugs using forensic analytical methods.
CO4 :	Evaluate alcohol levels using forensic analytical techniques.
CO5 :	Apply chromatographic methods for forensic sample analysis.

UNIT I :INTRODUCTION TO FORENSIC SCIENCE	**9 Hrs.**
Definition, History, Development and Scope of Forensic Science in India– Basic Principles of Forensic Science and its Significance, Organization and Functioning of State and Central Forensic Science Laboratories, Ethics in Forensic Science.	

UNIT II :CRIME DETECTION	**9 Hrs.**
Accidental explosions during manufacture of matches and fire-works (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: finger prints and their matching using computer records– Smell tracks and police dogs– Analysis of blood and other body fluids in rape cases–Typing of blood– DNA finger printing for tissue identification in disembered bodies–Blood stains on clothing– Cranial analysis (head and teeth).	

UNIT III:DRUG ANALYSIS	9 Hrs.
Classification of drugs, Analytical methods for drug identification, Legal aspects of drug analysis, Drug Metabolism and Pharmacokinetics, Forensic Toxicology of Drugs, Emerging Drug Trends, Forensic Analysis of Drug Impurities, Case Studies in Drug Analysis.	

UNIT IV:ALCOHOL AND BREATH ANALYSIS	9 Hrs.
Chemistry of alcohol metabolism, Techniques for detecting alcohol in breath and blood, Legal implications of alcohol analysis, Chemical reactions involved in alcohol metabolism and detection, Instrumentation for Alcohol Detection, Alcohol Impairment and Its Effects, Forensic Analysis of Alcohol Levels in Postmortem Samples, Advances in Non-Invasive Alcohol Detection Methods, Case Studies in Alcohol Analysis.	

UNIT V : CHROMATOGRAPHY IN FORENSIC ANALYSIS	9 Hrs.
Types of chromatography (GC, HPLC, TLC) and its applications in forensic science, Case studies involving chromatography, Optimization of Chromatographic Conditions, Detection Methods in Chromatography, Sample Preparation Techniques, High-Performance Thin-Layer Chromatography (HPTLC), Quantitative Chromatographic Analysis.	

Total Hours: 45

TEXTBOOKS :	
1.	Dean, J. R. "Forensic Chemistry". John Wiley & Sons.
2.	Levine, B. "Principles of Forensic Toxicology". Springer.
3	Clark, C. C. "Handbook of Forensic Drug Analysis". Elsevier.
4.	Borkenstein, R. F. "Alcohol, Drugs, and Human Performance". Institute of Police Technolog y and Management.
5.	Gennaro, M. C. "Chromatography and Analysis of Pharmaceuticals". Springer.

REFERENCE BOOKS :	
1.	Forensic Chemistry – Suzanne Bell, Pearson.
2.	Clarke's Analysis of Drugs and Poisons – Anthony C. Moffat, Pharmaceutical Press.
3.	Forensic DNA Typing – John M. Butler, Academic Press.

WEB REFERENCES :	
1.	https://www.youtube.com/watch?v=EUrRpTJyHsg&list=PL_a1TI5CC9RGWNkPEF5CMfMgin9FaVESN
2.	https://www.youtube.com/watch?v=eu4mjU5QLEY&list=PLCP8L39atqUrkDliAkEMdIMA_idd_v0AU
3.	https://www.youtube.com/watch?v=c6hbbv0GpvY&list=PLho7QJrwpUbS5QPajQ_fCNJ-G8Pc7xvtj

U24CHT507	Green Chemistry	L	T	P	C	Total
		3	0	0	3	45

COURSE OBJECTIVES:

To understand the principles and significance of green chemistry.
To learn the use of green reagents and environmentally benign solvents.
To analyze the green chemical techniques for sustainable synthesis.
To apply greener approaches to conventional organic reactions.
To evaluate the green industrial processes and sustainable manufacturing.

COURSE OUTCOMES:

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

CO1 :	Explain the principles and concepts of green chemistry.
CO2 :	Select appropriate green reagents and solvents for chemical processes.
CO3 :	Apply green chemical techniques in organic synthesis.
CO4 :	Perform conventional reactions using greener methodologies.
CO5 :	Evaluate industrial processes based on green chemistry principles.

UNIT I :INTRODUCTION TO GREEN CHEMISTRY	**9 Hrs.**
Introduction – inception and evolution of green chemistry – principles of green chemistry – the green chemistry expert systems - the measure of greenness – safety and risk indices – the hierarchical approach – green chemistry and sustainable development - pollution control to pollution prevention - Indian perspective on green chemistry – information technology and sustainable development.	

UNIT II :GREEN REAGENTS	**9 Hrs.**
Green reagents – safer solvents - green solvents – water as a solvent – solvent free conditions – support reagents – ionic liquids and their applications – super critical systems (CO_2) as green solvents – hydrogen peroxide in green oxidation reactions – dimethyl carbonate, a green solvent and an ambient reagent.	

UNIT III:GREEN CHEMICAL TECHNIQUES - I	9 Hrs.
Environmentally benign technologies by green chemistry (with examples) – microwave assisted synthesis-electro-organic synthesis – photochemical degradation as a green approach for waste treatment - catalysis and green chemistry – supported catalysts and reagents for green chemistry – heterogenized reactions for green chemistry –oxidation technology for waste water treatment - green chemistry using biocatalytic reactions.	

UNIT IV:GREEN CHEMICAL TECHNIQUES - II	9 Hrs.
Aqueous phase reactions, solid state reactions, enzymatic transformations, sonicated reactions – usual organic reactions (Benzoin condensation, Michael Addition, Heck Reaction, Darzen reaction, Heck reaction, Claisen arrangement) in a greener way.	

UNIT V - GREEN INDUSTRIAL PROCESSES AND OPERATIONS	9 Hrs.
Cleaner production - industrial perspectives - reactions and reactor designs - micromixers - unit operations - reactions with separation processes alternate energy resources - inherent safety - green chemistry and industries - the food and flavor industry - the maleic anhydride manufacturing process - chelants - the surfactant industry - industries in need of support to go green - the semiconductor manufacture industry - the dye industry - the textile industry - the tannery industry - the sugar and distillery industries - the paper and pulp industry - the paint industry - Green chemistry in future.	

Total Hours: 45

TEXTBOOKS :	
1.	Mukesh Doble and Anilkumar Kruthiventi, 'Green Chemistry and Processes', reprint, Science Press, 2007.
2.	Paul T. Anastas and Tracy C. Williamson, 'Green chemistry: frontiers in benign chemical syntheses and processes', Oxford University Press, 1998.
3.	Green Chemistry – V. K. Ahluwalia, Narosa Publishing House.

REFERENCE BOOKS :	
1.	V. K. Ahluwalia, 'Green Chemistry - Environmentally Benign Reactions', 1st edition, Ane Books Pvt Ltd, 2009.
2.	M. M. Srivastava, Rashmi Sanghi, 'Green Chemistry - Environment Friendly Alternatives', 2nd edition, Narosa Publishing House, 2005.

2.	M. M. Srivastava, Rashmi Sanghi, 'Green Chemistry - Environment Friendly Alternatives', 2nd edition, Narosa Publishing House, 2005.
3.	Industrial Green Chemistry – Serge Kaliaguine, Elsevier.

WEB REFERENCES :	
1.	https://www.youtube.com/watch?v=b-vmjagCwN8
2	https://www.youtube.com/watch?v=Ym3HyZGsOg4&list=PLLy_2iUCG87CZ8WsOQA3WWb1IqAuAlAuB
3	https://www.youtube.com/watch?v=GRRxZvIvxug&list=PLh9mgdi4rNeyvVB2Bf106ipzNnZfM9X9G

U24BAT568	Fundamentals of Management	L	T	P	C	Total
		2	0	0	2	30

COURSE OBJECTIVES:

• To understand the fundamental principles and functions of management
• To explore various leadership theories and styles to develop effective leadership skills
• To develop skills in planning, decision making, and problem-solving within organizational contexts
• To learn techniques for organizing teams, delegation, motivation, and conflict management
• To gain insights into controlling processes, ethical leadership, and managing change in dynamic environments

COURSEOUTCOMES:

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

CO1 :	Explain the key functions of management and identify the roles and responsibilities of managers.
CO2 :	Differentiate between management and leadership and apply appropriate leadership styles in different situations.
CO3 :	Formulate effective plans and make informed decisions using relevant analytical tools.
CO4 :	Organize and lead teams efficiently by applying delegation, motivation, and conflict resolution strategies.
CO5 :	Implement controlling mechanisms and demonstrate an understanding of ethical leadership and change management principles.

UNIT I :INTRODUCTION MANAGEMENT	**9 Hrs.**
Definition and importance of Management-Functions of management (Planning, Organizing, Leading, Controlling)-Levels and roles of Management-Evolution of management theories	

UNIT II :ESSENTIALS OF LEADERSHIP	**9 Hrs.**
Leadership vs Management-Leadership theories and Styles-Emotional intelligence in Leadership-	

Leadership communication skills

UNIT III :PLANNING AND DECISION MAKING	9 Hrs.
Importance and types of Planning-Decision-making process and Tools-Strategic, tactical, and operational Planning-Problem-solving techniques	

UNIT IV :ORGANIZING AND TEAM MANAGEMENT	9 Hrs.
Organizational structure and design -Delegation and empowerment -Building effective teams - Conflict resolution and motivation	

UNIT V - CONTROLLING AND CONTEMPORARY LEADERSHIP CHALLENGES	9 Hrs.
Controlling and performance management -Change management -Ethics and social responsibility in leadership -Innovation and leadership in the digital age	

Total Hours: 45

TEXT BOOKS :	
1.	Koontz H., Weihrich H., and Cannice M. V., Essentials of Management: An International, Innovation, and Leadership Perspective, 11th Edition, McGraw-Hill Education, 2020.
2.	Robbins S. P., Coulter M., and DeCenzo D. A., Fundamentals of Management, 11th Edition, Pearson Education, 2022.
3.	Daft R. L., Management, 15th Edition, Cengage Learning, 2022.
4.	Lussier R. N., Management Fundamentals: Concepts, Applications, and Skill Development, 8th Edition, SAGE Publications, 2021.
5.	Northouse P. G., Leadership: Theory and Practice, 9th Edition, SAGE Publications, 2022.

REFERENCE BOOKS :	
1.	Robbins S. P. and Judge T. A., Organizational Behavior, 19th Edition, Pearson Education, 2023.
2.	Drucker P. F., Management: Revised Edition, Harper Business, 2008.

3.	Goleman D., Leadership: The Power of Emotional Intelligence, More Than Sound, 2017.
4.	Yukl G., Leadership in Organizations, 9th Edition, Pearson Education, 2020.
5.	Bateman T. S. and Snell S. A., Management: Leading & Collaborating in a Competitive World, 15th Edition, McGraw-Hill Education, 2023.

WEB REFERENCE :	
1.	https://hbr.org/topic/management
2.	https://www.mckinsey.com/capabilities/people-and-organizational-performance
3.	https://sloanreview.mit.edu/
4.	https://www.shrm.org/
5.	https://www.pmi.org/

BoS Chairman

U24UMP592	Foreign Language -I	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

• To identifier et prononcercorrectementl'alphabetfrançais, les accents et les signes de ponctuation.
• To employer les articles définis, indéfinis, le genre, le nombre et les nombres dans des phrases • simples
• To conjuguer et utiliser les verbes*être* et *avoir*ainsique les verbesréguliers au présent de • l'indicatif
• To utiliser les adjectifsqualificatifs, les couleurs, les prépositions et le vocabulairefondamental • dans des phrases simples
• To développerune communication élémentaire en français à travers des activitésorales et écrites • adaptées au niveaudébutant

COURSEOUTCOMES:

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

CO1 :	Identifier et prononcercorrectementl'alphabetfrançais, les accents et les signes de ponctuation
CO2 :	Employer les articles définis, indéfinis, le genre, le nombre et les nombres dans des phrases simples
CO3 :	Conjuguer et utiliser les verbes*être* et *avoir* au présent de l'indicatif
CO4 :	Utiliser les adjectifs, les couleurs et les prépositionsdans des situations de communication de base
CO5 :	Produire de courtes expressions orales et écritesenutilisant les structures grammaticalesélémentaires

UNIT I : Alphabet — Signe orthographiques	**3 Hrs.**
Alphabet —Signeorthographiques L'accntaigu- é L'accentgrave-	

è L'accentcirconflexe -ê

Le signes de ponctuation['.' - Point, '-,'- la virgule, '...'-le point de suspections,'()'- parenthèses, '?'-le point d'interrogation,! '-le point d'exclamation,«»—les guillemets,'-'letiret

Leçon—1

ArticleIndéfini. (un,une,des) ArticleDéfini (le,la,les)Masculin et Féminin

Prononciation—Expliquesauxélèves

UNIT II : Les Nombres	**3 Hrs.**

Leçon2,3—LesNombres

Masc-unlivre,

Deslivres(pluriel) Fem-unetable,des tables(pluriel)

Article singulieretpluriel

AuxiliaireVerbe(tohave,tobe)—Verbe'avoir'etVerbeêtre'

UNIT III : Les Prepositions	**3 Hrs.**

(dans,sur,sous,devantetderrière)

Ilfautdonnerbeaucoupdesexceptionsauxélèves.

Leçon 4

Adjectif—touteslesCouleurs.

Expliquerauxélèves:-

UNIT IV :Adjectif—ToutesLesCouleurs	**3 Hrs.**

Lesmotsmasculinetlesmotsdeféminin

Blanc — blanche Brun- brune

Jaune-jaune Rouge-rouge

Ilfautexpliquertoutes

Les couleurs

Dictées à préparer – la classe

UNIT V :Verbeêtre (to have) etverbeavoir (to be)	3 Hrs.
Verbeêtre(tohave)etverbeavoir(tobe) Donner ,écouter, regader, changer, téléphoner,.. des exemples Adjectif(grand, petit, laid, beau…) Matérieles	

Total Hours: 15

TEXT BOOKS:	
1.	Capelle, Guy &Menand, Robert. Le Nouveau Taxi ! 1. Hachette Français Langue Étrangère.
2.	Mauger, Gaston. Cours de Langue et de CivilisationFrançaises – Tome I. Hachette.
3.	Girardet, Jacky &Pécheur, Jacques. Écho A1 – Méthode de Français. CLE International.
4.	Abry, Dominique et al. Saison 1 – Méthode de Français. Didier.
5.	Alter Ego + A1. Hachette Français Langue Étrangère.

REFERENCE BOOKS:	
1.	LivreG.Mauger — Cours de langue et de civilisationfrançaises
2.	Bescherelle: La Conjugaison Pour Tous – Hatier Publications
3.	Le Nouveau Taxi! 2 – Méthode de Français by Guy Capelle& Robert Menand, Hachett
4.	Bescherelle – La Conjugaison pour Tous. Hatier.
5.	Delatour, Y. et al. Nouvelle Grammaire du Français. Hachette.

WEB REFERENCES:	
1.	https://apprendre.tv5monde.com
2.	https://www.francaisfacile.com
3.	https://savoirs.rfi.fr
4.	https://www.lepointdufle.net
5.	https://www.fun-mooc.fr

BoS Chairman

U24UMP593	Green credit -V	L	T	P	C
		0	0	2	1

TERRACE GARDEN ESTABLISHMENT

COURSE OBJECTIVES

- To illustrate the methods and techniques for growing vegetables & their cultural activities in terrace conditions due to the absence of sufficient knowledge on terrace cultivation.
- To analyze the management practices associated with water, soil, pest etc.

COURSE OUTCOMES

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

CO1 – Gain knowledge in the popular methods used in terrace gardening and understand the benefits of growing our own food. **(K2)**

CO2 – Acquire the practices of safe, pesticide-free, healthy green and fresh fruits or vegetables via terrace gardening. **(K4)**

MODULE -1 INTRODUCTION

- Definition and importance of terrace gardening
- Types of terrace gardening
- Selection of site and layout
- Benefits of a terrace garden
- Basic tools and materials required

MODULE-2 MANAGEMENT PRACTICES

- Water management
- Soil management
- Pest management
- Plant maintenance
- Plant protection measures

BoS Chairman