Evaluation/Scheme of Examination
M.Sc. (Chemistry)
1st Semester

S. No.	Course code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credit
				L	T	P	CT	TA	Total	ESE			
THEORIES													
1.	CH401	Physical Chemistry	Foundation Course	03	01	00	40	20	60	40	100	3:1:0	4
2.	CH402	Inorganic Chemistry	Foundation Course	03	01	00	40	20	60	40	100	3:1:0	4
3.	CH403	Organic Chemistry	Foundation Course	03	01	00	40	20	60	40	100	3:1:0	4
4.	CH404	Environmental Chemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4
5.	CH405	Modern Analytical Techniques	Core	03	01	00	40	20	60	40	100	3:1:0	4
PRACTICAL													
6.	CH419	Chemistry Lab Practical-1	Core	00	00	08	40	20	60	40	100	0:0:4	4
			Total	**15**	**05**	**08**	**240**	**120**	**360**	**240**	**600**	**24**	**24**

2nd Semester

S. No.	Course code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credit
				L	T	P	CT	TA	Total	ESE			
THEORIES													
1.	CH408	MIMA & Computational Techniques	Core	03	01	00	40	20	60	40	100	3:1:0	4
2.	CH409	Chemistry of Natural Products	Core	03	01	00	40	20	60	40	100	3:1:0	4
3.	CH411	Pharmaceutical Chemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4
4.	CH420	Surface Chemistry and Electrochemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4
5.	CH421	Coordination and Organomettalic Chemistry of Transition Elements	Core	03	01	00	40	20	60	40	100	3:1:0	4
PRACTICAL													
6.	CH422	Chemistry Lab Practical-2	Core	03	01	00	40	20	60	40	100	0:0:4	4
			Total	**15**	**05**	**08**	**240**	**120**	**360**	**240**	**600**	**24**	**24**

3rd Semester

S. No.	Course code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credit
				L	T	P	CT	TA	Total	ESE			
THEORIES													
1.	CH501	Polymer Chemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4
2.	CH513	Organic reaction, Reagents & Heterocyclic Chemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4
3.	CH514	Chemical Kinetics and Chemical Equilibrium	Core	03	01	00	40	20	60	40	100	3:1:0	4
4.	CH515	Inorganic Reaction Mechanism and catalysis	Core	03	01	00	40	20	60	40	100	3:1:0	4
5.	CH516	Quantum Chemistry and Molecular Spectroscopy	Elective	03	01	00	40	20	60	40	100	3:1:0	4
6.	CH506	Bioinorganic & Supra molecular Chemistry	Elective										
PRACTICAL													
6.	CH507	Industrial Chemistry Practical-3	Core	03	01	00	40	20	60	40	100	0:0:4	4
			Total	**15**	**05**	**08**	**240**	**120**	**360**	**240**	**600**	**24**	**24**

4th Semester

S. No.	Course code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credit
				L	T	P	CT	TA	Total	ESE			
THEORIES													
1.	CH518	Spectral Techniques in Inorganic Chemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4
2.	CH509	Green Chemistry	Elective	03	01	00	40	20	60	40	100	3:1:0	4
3.	CH519	Computational method in Chemistry	Elective										
PRACTICAL													
4.	CH520	Seminar	Core	00	00	04	00	00	00	100	100	0:0:2	2
5.	CH521	*Project Training & Evaluation	Core	00	00	00	00	00	00	300	300	10	10
			Total	**06**	**02**	**04**	**80**	**40**	**120**	**480**	**600**	**20**	**20**

CT= Class Test, **TA**= Teacher's Assessment, **ESE**= End Semester Examination; **Sessional**=CT+TA; **Subject Total**=Sessional+ESE;

Total Credit=24+24+24+20=92

***The Evaluation scheme for the Project Training:**

Course Title	Course Code	Dissertation	Presentation	Viva/Discussion	Total
Industrial Training & Project Evaluation	CH512	200	50	50	300

SYLLABI

SEMESTER – I

1. Name of the Department: Chemistry						
2. Course Name	**PHYSICAL CHEMISTRY**			**L**	**T**	**P**
3. Course Code	**CH401**			3	1	0
4. Type of Course (use tick mark)				**Core ()**	**DE ( )**	**FC (√)**
5. Pre-requisite (if any)	B.Sc. with Chemistry	**6. Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ( )	Every Sem ( )
7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: The purpose of this postgraduate course is to impart basic and fundamental knowledge of physical chemistry. It is applied in almost all the fields starting from Chemistry to biology, information technology as well as the engineering. After the successfully completion of the course, the students are provided a sound foundation to take up Ph.D. course in the future.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Students would analyze the idealized version of a gas, a perfect gas and shows how its equation of states may be assembled experimentally.
CO2	Students would able to develop the concept of conservation of energy; assess the energy changes during physical and chemical process.
CO3	Students would differentiate between spontaneous and non-spontaneous process and understand how Gibbs free energy is related to maximum non-expansion work.
CO4	Students would explore the rate of chemical reactions and analyzed how rate of a chemical reaction is varying with change of concentration, pressure and temperature.
CO5	Students would develop the concept of photochemistry and get inside of Lambert-Beer Law, Grothus – Drapper law, Stark – Einstein law, quantum Efficiency and its determination.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Properties of Gases**

The states of gases, gases laws and deviation from ideal behavior, Vander Waals equation of state; Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constants and vander Waals constants, the law of corresponding states, reduced equation ofstate. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, means free path and collision diameter.

Unit-2	**Number of lectures =08**	**Title of the unit: Classical Thermodynamics**

System & surroundings, intensive and extensive properties, State and path functions and their differentials, Thermodynamic processes, concept of heat and work. First Law of Thermodynamics; Statement, definition of internal energy and enthalpy, Heat capacity, heat capacities at constant volume and pressure, Joule's law – Joule-Thomson coefficient and inversion temperature. Second Law of Thermodynamics: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, clausius inequality, entropy as a criteria of spontaneity and equilibrium, Equilibrium change in ideal gases and mixing of gases, Maxwell's relations.

Unit-3	**Number of lectures = 08**	**Title of the unit: Entropy and Free energy**

Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropychange,VariationofGandAwithP,VandT.Nernstheattheorem,statementandconceptofresidualentropy.ChemicalPotentialandpartialm olarproperties: Gibbs-Duhem equation, concept of fugacity and its determination.

Unit-4	**Number of lectures = 08**	**Title of the unit: Chemical Kinetics**

Rate of a reaction, factors influencing the rate of a reaction; mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order,halflifeandmeanlife,Determinationoftheorderofreaction–differentialmethod,methodofintegration,methodofhalflifeperiodandisolationmethod. Radioactive decayas a first order phenomenon, Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

Unit-5	**Number of lectures = 08**	**Title of the unit: Photochemistry**

Interaction of radiation with matter, difference between thermal and photochemical processes, Laws of photochemistry: Grothus – Drapper law, Stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state, Lambert-Beer Law: quantum Efficiency and its determination, Qualitative description of fluorescence, phosphorescence, non- radiative processes (internal conversion, intersystem crossing), photosensitized reactions – energy transfer processes (simple examples), Kinetics of Photo chemical reaction. (Hydrogen-Bromine, Hydrogen-Chlorine, Decomposition of Hydrogen Iodide and kinetics of Dimerization of Anthracene).

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Students would analyze the idealized version of a gas, a perfect gas and shows how its equation of states may be assembled experimentally.	**3**	**2**	**2**		**1**	**3**	**3**	**3**
CO2	Students would able to develop the concept of conservation of energy; assess the energy changes during physical and chemical process.	**3**	**2**	**2**		**1**	**2**	**2**	**2**
CO3	Students would differentiate between spontaneous and non-spontaneous process and understand how Gibbs free energy is related to maximum non-expansion work.	**3**	**2**	**3**		**1**	**3**	**2**	**3**
CO4	Students would explore the rate of chemical reactions and analyzed how rate of a chemical reaction is varying with change of concentration, pressure and temperature.	**3**	**2**	**3**		**1**	**3**	**3**	**2**
CO5	Students would develop the concept of photochemistry and get inside of Lambert-Beer Law, Grothus – Drapper law, Stark – Einstein law, quantum Efficiency and its determination.	**3**	**2**	**1**		**1**	**3**	**2**	**1**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self-learning / E-learning component

1. http://home.iitk.ac.in/~gtm/thermodynamics/ui/TOC.htm
2. https://nptel.ac.in/courses/115103113/
3. https://nptel.ac.in/content/storage2/courses/122101001/downloads/lec-27.pdf
4. http://www.cdeep.iitb.ac.in/webpage_data/nptel/Core%20Science/Engineering%20Chemistry%201/TOC-mainM6.htm
5. https://www.youtube.com/watch?v=SgTuWj9Tj80

13. Books recommended:

1. Physical Chemistry, P.W. Atkins,ELBS
2. Thermodynamics – J. Rajaram and J.C. Kuriacose – EducationalPublishers.
3. Quantum Chemistry – Eyring, Walter,Kinball
4. Statistical Physics (Part I) (Course of Theoretical Physics Vol. 5) – L.D. London. & E.M. Lefshitz Perganion Zpress,London.
5. Principles of Physical Chemistry by Puri, Sharma andPathan.

1. Name of the Department: Chemistry						
2. Course Name	**INORGANIC CHEMISTRY**			**L**	**T**	**P**
3. Course Code	**CH402**			3	1	0
4. Type of Course (use tick mark)				**Core ()**	**DE ( )**	**FC (√)**
5. Pre-requisite (if any)	B.Sc. with Chemistry	**6. Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ( )	Every Sem ( )
7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: The purpose of this course is to develop the deep understanding of general characteristic properties of transition elements, nomenclature and isomerism in coordination compounds, organometallic chemistry of transition elements, bioinorganic chemistry and process in human and to gain the knowledge of basics of instrumental spectroscopic techniques.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Students will be able to understand the approaches to the development of d block fundamental with CFT/VBT/MOT and its widespread applications.
CO2	Students will have a firm foundation in the IUPAC nomenclatures of the complexes and understand technical literature related to the discipline.
CO3	Students will be able to know about the key concepts of inorganic and organometallic chemistry including those related to synthesis, reaction chemistry, and structure and bonding.
CO4	Students will be able to understand the metal component in protein structure and molecular modeling, including the use of the computer program. Transport mechanisms across cell membranes.
CO5	Students will be able to understand the basic and advanced instrumental techniques used in inorganic synthesis including spectroscopic and analytical techniques for identification and characterization of complex molecules.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Coordination Compounds**

General characteristic properties of transition elements, Werner's theory, Effective atomic number, Shapes of d orbitals. Bonding in transition metal complexes; Valence bond theory, Crystal field theory; Octahedral complexes, effects of crystal field splitting, tetrahedral distortion of octahedral complexes (Jahn-Teller Distortion), Square planar arrangements, tetrahedral complexes, chelates, magnetism, Molecular orbital theory.

Unit-2	**Number of lectures =08**	**Title of the unit: Nomenclature And Isomerism In Coordination Compounds**

Nomenclature of co-ordination compounds, isomerism in coordination compounds; Polymerization, Ionization, Hydrate, Linkage, Coordination, Coordi nation position isomerism. Stereoisomerism; Geometrical and optical isomerism. Metal carbonyls, metal clusters and sandwich compounds.

Unit-3	**Number of lectures = 08**	**Title of the unit: Organometallic Chemistry Of Transition Elements**

Ligand hapticity, electron count for different types of organometallic compounds, 18 and 16 electron rule exceptions, synthesis, structure and bonding, organometallic reagents in organic synthesis and in homogeneous catalytic reactions (Hydrogenation, hydroformylation, isomerisation and polymerisation).

Unit-4	**Number of lectures = 08**	**Title of the unit: Bioinorganic Chemistry**

Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine.

Unit-5	**Number of lectures = 08**	**Title of the unit: Characterization Of Inorganic Compounds**

Characterization of inorganic compounds by IR, Raman, NMR, EPR, Mossbauer, UV-Vis, NQR, MS, electron spectroscopy and microscopic techniques..

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Students will be able to understand the approaches to the development of d block fundamental with CFT/VBT/MOT and its wide spread applications.	**3**	**1**	**1**		**2**	**1**		
CO2	Students will have a firm foundation in the IUPAC nomenclatures of the complexes and understand technical literature related to the discipline.	**3**	**2**	**1**		**2**	**2**		
CO3	Students will be able to know about the key concepts of inorganic and organometallic chemistry including those related to synthesis, reaction chemistry, and structure and bonding.	**3**	**2**	**2**		**2**	**2**		
CO4	Students will be able to understand the metal component in protein structure and molecular modeling, including the use of the computer program and transport mechanisms across cell membranes.	**3**	**2**	**2**		**2**	**2**		
CO5	Students will be able to understand the basic and advanced instrumental techniques used in inorganic synthesis including spectroscopic and analytical techniques for identification and characterization of complex molecules.	**3**	**2**	**1**		**2**	**2**		

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self-learning / E-learning component

1. https://freevideolectures.com/course/3412/co-ordination-chemistry
2. http://wwwchem.uwimona.edu.jm/courses/IC10Kiso.pdf
3. https://nptel.ac.in/courses/104101091/
4. https://nptel.ac.in/courses/104104109/
5. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/104106074/lec24.pdf

13. Books recommended:

1. F. Albert Cotton, Geoffery Wilkinson, Carlos A. Murillo and Manfred Bochmann. Advanced Inorganic chemistry, Sixth edition, Wiley India Pvt.Ltd.
2. J. D. Lee, Concise Inorganic Chemistry, Fifth edition, Wiley India Pvt.Ltd.
3. J H Huheey, Inorganic Chemisry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York(1972).

1. Name of the Department: Chemistry						
2. Course Name	**ORGANIC CHEMISTRY**			**L**	**T**	**P**
3. Course Code	**CH403**			3	1	0
4. Type of Course (use tick mark)				**Core ( )**	**DE ( )**	**FC (√)**
5. Pre-requisite (if any)	B.Sc. with Chemistry	**6. Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ( )	Every Sem ( )

7. Total Number of Lectures, Tutorials, Practicals

Lectures = 30	**Tutorials = 10**	**Practical = Nil**

8. COURSE OBJECTIVES: Students will be able to gain knowledge of Generation, stability and reactivity of intermediates, Name reactions. pericyclic reactions, concerted pi electron shift and minimize environmental pollution through without use of solvents concepts of stereochemistry of acyclic & cyclic compounds, stereo chemical properties and their applications.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Analyze and compare reactivity and stability of carbocations, carbanions, free radicals, carbenes, nitrenes and benzynes and addition reactions with electrophilic, nucleophilic or radical species
CO2	Comprehension of types of Organic reaction mechanisms involving elimination and substitution reactions with electrophilic, nucleophilic or radical species.
CO3	Able to evaluate different types of Name reactions and its mechanism.
CO4	Know about Pericyclic reactions, types of Pericyclic reactions, stereochemistry, thermal and photochemical cyclisation, Cope and Claisen rearrangement.
CO5	Understand the Principles of stereochemistry, Configurational and conformational isomerism in acyclic and cyclic compounds, stereogenicity, stereoselectivity, enantioselectivity and diastereoselectivity.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Reactive intermediates**

Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and benzynes. Organic reaction mechanisms involving addition reactions with electrophilic, nucleophilic or radical species.

Unit-2	**Number of lectures =08**	**Title of the unit: Reaction mechanisms and Name reactions**

Organic reaction mechanisms; involving, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Neighbouring group participation, elimination: E2 vs E1, elimination vs substitution. Aldol condensation, Cannizzaro reaction, Hofmann, Beckmann and Fries rearrangements, Reimer-Tiemann reaction.

Unit-3	**Number of lectures = 08**	**Title of the unit: Name reactions**

Reformatsky and Grignard reactions, Michael addition, Friedel-Crafts reaction, Witting reaction, Oppenaur oxidation, Clemmensen reduction, Wolff-Kishner reduction, Meerwein-Ponndorf Verley reduction and birch reduction, hydroboration-oxidation, oxymercuration and deoxymercuration.

Unit-4	**Number of lectures = 08**	**Title of the unit: Pericyclic, Electrocyclic, Cycloaddition reactions and Sigmatropic rearrangements**

Pericyclic reactions: Introduction, π molecular orbital of ethylene and 1,3-butadiene. Electrocyclic reactions: Introduction, stereochemistry for the ring opening and ring closing electrocyclic reactions, thermal and photochemical cyclisation of (4n) and (4n+2) system. Cycloaddition reactions: Introduction, Thermal andphotochemical induced (2+2) and (4+2) cycloaddition reactions. Sigmatropic rearrangements: Introduction, classification, Cope and Claisen rearrangement..

Unit-5	**Number of lectures = 08**	**Title of the unit: Principles of stereochemistry**

Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity and diastereoselectivity.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Analyze and compare reactivity and stability of carbocations, carbanions, free radicals, carbenes, nitrenes and benzynes and addition reactions with electrophilic, nucleophilic or radicalspecies.	**3**	**1**	**2**	**1**		**2**	**2**	**2**
CO2	Comprehension of types of Organic reaction mechanisms involving elimination and substitution reactions with electrophilic, nucleophilic or radicalspecies.	**3**	**1**	**2**	**1**		**2**	**2**	**2**
CO3	Able to evaluate different types of Name reactions and its mechanism.	**3**	**1**	**2**	**1**		**2**	**2**	**2**
CO4	KnowaboutPericyclicreactions,typesofPericyclicreactions,stereochemistry,thermalandphotochemical cyclisation, Cope and Claisen rearrangement.	**3**	**1**	**2**	**1**		**3**	**3**	**2**
CO5	Understand the Principles of stereochemistry, Configurational and conformational isomerism in acyclic and cyclic compounds, stereogenicity, stereoselectivity, enantioselectivity and diastereoselectivity.	**3**	**1**	**2**	**1**		**2**	**2**	**2**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self-learning / E-learning component

1. https://nptel.ac.in/courses/104105104/
2. https://nptel.ac.in/courses/104101005/
3. https://nptel.ac.in/courses/104103023/
4. https://nptel.ac.in/courses/104106077/
5. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod8.pdf

13. Books recommended:

1. Advanced Organic Chemistry (Reactions, Mechanisms and Structure): Michel B. Smith and Jerry March, 4th Edition, Wiley IntersciencePublication.
2. A Guidebook to Mechanism in Organic Chemistry by Peter Sykes, Six edition, Pearsonpublication.
3. Organic Chemistry by Robert Thornton Morrison, Robert Neilson Boyd, and Saibal Kanti Bhattacharjee, Seventh edition, Pearsonpublication.
4. Organic Chemistry by Jonathan Clayden, Nick Greeves, and Stuart Warren, Second edition, OxfordPublication.
5. Organic Chemistry by T.W.Graham Solomons, and Craig B. Fryhle, Ninth edition, WileyPublication.
6. Organic Chemistry by IL Finar, Volume 1 & 2, Sixth edition, PearsonPublication.

1. Name of the Department: Chemistry						
2. Course Name	ENVIRONMENTAL CHEMISTRY			L	T	P
3. Course Code	CH404			3	1	0
4. Type of Course (use tick mark)				Core (√)	DE ( )	FC ( )
5. Pre-requisite (if any)	B.Sc. with Chemistry	6. Frequency (use tick marks)	Even ()	Odd (√)	Either Sem ( )	Every Sem ( )
7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 30		Tutorials = 10		Practical = Nil		

8. COURSE OBJECTIVES: The main objectives of this course is to study various types of pollutants, their sources, effects on living and non living species and related control measures.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Evaluate different types of air pollutants, their harmful effects on living and non living species, their control measures; Study of Global Warming, Green House Effect and Ozone Layer Depletion.
CO2	Analyze the various factors of water quality assessment parameters, water pollutants and their sources and different types of waste water treatment processes.
CO3	Understand the importance of soil composition; Analyze various types of soil pollutants, their control and related standards.
CO4	Evaluate the various types of waste and their toxicity aspects and management.
CO5	Understand the sources of heavy metals and their health hazards

10. Unit wise detailed content

Unit-1	Number of lectures = 08	Title of the unit: Air pollutants

CO, CO2, ozone, CFC, & NOx, ozone depletion, global warming, Harmful effects of pollutants on living and non-living species, Analytical methods for monitoring air pollutants, international and national standards.

Unit-2	Number of lectures =08	Title of the unit: Physical, chemical and biological water quality parameters

Physical, chemical and biological water quality parameters; their assessment; Water pollution; water pollutants; toxicity aspects; international and national standards; control; Water sampling techniques; Water treatment processes: aeration, solid purification, nanofiltration, chemical treatments, reverses osmosis, desalination. Waste water treatment processes. Water table maintenance & harvesting methods.

Unit-3	Number of lectures = 08	Title of the unit: Composition of soil

Inorganic and organic components, micro and macronutrients; Soil pollution; Fertilizers, insecticides, pesticides, plastics, toxic metals, dyes, surfactants; toxicity aspects; international and national standards; control.

Unit-4	Number of lectures = 08	Title of the unit: Industrial waste

Toxic aspects, management and disposal; Radioactive, municipal, agricultural and biomedical waste – toxicity hazards. Bhopal gas tragedy, Chernobyl disaster.

Unit-5	Number of lectures = 08	Title of the unit: Heavy metal in the environment

Sources of heavy metals; Poisoning of heavy metals in every bite; Mercury, Copper, Chromium, Cadmium, Cobalt, Lead, Arsenic.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Evaluate different types of air pollutants, their harmful effects on living and non living species, their control measures; Study of Global Warming, Green House Effect and Ozone LayerDepletion.	3	2	3	3	3	3	3	2
CO2	Analyze the various factors of water quality assessment parameters, water pollutants and their sources and different types of waste water treatmentprocesses.	3	2	3	3	3	3	3	2
CO3	Understand the importance of soil composition; Analyze various types of soil pollutants their control and relatedstandards.	3	1	3	3	3	3	3	3
CO4	Evaluate the various types of waste and their toxicity aspects and management.	3	2	3	3	2	3	3	2
CO5	Understand the sources of heavy metals and their health hazards.	3	2	3	3	3	3	3	2

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self-learning / E-learning component

1. https://nptel.ac.in/content/storage2/courses/105102089/air%20pollution%20(Civil)/Module-1/2.htm
2. https://www.youtube.com/watch?v=xw9FPlq0sJ8
3. https://www.youtube.com/watch?v=7kizaNBowrw
4. https://www.youtube.com/watch?v=dnQjYXXX17A
5. https://www.ukessays.com/essays/environmental-sciences/the-issue-of-heavy-metals-contamination-environmental-sciences-essay.php

13. Books recommended:

1. Environmental Chemistry Manahan, Stanley E, 2004, Taylor & FrancisLtd.
2. Basic Concepts of Environmental Chemistry, Desley W. Connell, 1 edition,CRC-Press
3. Environmental Chemistry: A Global Perspective, Gary W. Vanloon Stephen J. Duffy , Oxford Univ Pr(Sd).
4. Introduction To Environmental Chemistry, Reid, Brian J. Blackwell ScienceLtd.
5. Chemistry of the Environment, Thomas G. Spiro, William M. Stigliani, 2nd Edition, Prentice Hallpublication.

1.Name of the Department: Chemistry						
2.Course Name	MODERN ANALYTICAL TECHNIQUES			L	T	P
3.Course Code	CH405			3	1	0
4.Type of Course (use tick mark)				Core(√)	DE( )	FC( )
5.Pre-requisite(if any)	B.Sc. with Chemistry	6.Frequency (use tick marks)	Even ( )	Odd (√)	Either Sem ( )	EverySem( )

7.Total Number of Lectures, Tutorials, Practicals

Lectures=30	Tutorials=10	Practical=Nil

8. COURSE OBJECTIVES: The course aims at providing knowledge of principles and instrumentations of UV, IR, NMR, Atomic absorption spectroscopy and Mass spectrometry. Make the students able to interpret and assign spectroscopic data as a tool for structural elucidation.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Explain the effect of conjugation, solvent polarity and non-bonding electrons on a UV/Vis absorption spectrum. Evaluate the utility of UV/Vis spectroscopy as a qualitative and quantitative method. Application of correct Woodward-Fieser rules to calculate wavelength of maximum absorption of organic compounds.
CO2	Comprehension of factors affecting vibrational, frequencies, vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, acids, anhydrides, interpret and assign IR spectroscopic data as a tool for structural elucidation.
CO3	Argue how nuclear spins are affected by a magnetic field, and be able to explain what happens when radiofrequency radiation is absorbed. Identify the number of proton and carbon NMR signals expected from a compound given its structure, splitting pattern in the proton NMR spectrum of a compound given its structure, to assign peaks with the aid of a chart of chemical shifts from 1H and 13C NMR in an NMR spectrum to specific protons and carbons in a compound.
CO4	Become familiar with the mass spectrometric technique, different types of ionization techniques and sketch components of a mass spectrometer and functions of each. Application of a mass spectrometric technique, distinguish fragmentation methods. Interpretation of mass spectra
CO5	Comprehension of principle, instrumentation, interferences and Sample preparation, Applications of AAS

10.Unitwisedetailedcontent

Unit-1	Number of lectures=08	Title of the unit: UV Spectroscopy

Wave-like propagation of light, absorption of electromagnetic radiation by organic molecules allowed and forbidden transitions, instrumentation, effect of solvents on electronic transitions, formation and designation of absorption bands, conjugated systems and transition energies, unsaturated carbonyl compounds, dienes and conjugated polyenes, Woodward – Fieser rules

Unit-2	Number of lectures= 08	Title of the unit: IR Spectroscopy

Introduction, absorption in the infrared region, theory of infrared spectroscopy, instrumentation, molecular vibrations, calculation of vibrational frequencies, factors affecting vibrational frequencies, characteristic absorptions in common classes of compounds, fingerprint region, characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ether, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, acids, anhydrides), applications of infrared spectroscopy.

Unit-3	Number of lectures=08	Title of the unit: NMR Spectroscopy

Introduction, theory of NMR spectroscopy, Instrumentation, chemical shift, equivalent and nonequivalent protons, s pin-spin splitting, vicinal coupling and stereostructure, proton exchange reactions, nuclear overhauser effect (NOE), shift reagents, principle of C-13 NMR spectroscopy, Relaxation and dynamic processes - Spin lattice relaxation (T1) and Spin - spin relaxation (T2) measurements. Interpretation of NMR spectra of some representative compounds.

Unit-4	Number of lectures=08	Title of the unit: Mass Spectrometry

Introduction, basic theory, instrumentation, important useful terms in mass spectrometry, various modes of ionization (EI, CI, FD and FAB) and their applications, fragmentation patterns of various functional groups (alkanes, alkenes, alkynes, alcohols, ether, phenols, amines, ketones, aldehydes, esters, acids and anhydrides), molecular ion peak, metastable peak, Mclafferty rearrangements, Nitrogen rule.

Unit-5	Number of lectures=08	Title of the unit: Atomic Absorption

Spectrophotometry: Introduction, Principle, Instrumentation, Interferences- Spectral, Ionization, Physical and Refractory compound formation, Sample preparation, Internal standard and standard addition calibration and applications of AAS.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Explain the effect of conjugation, solvent polarity and non-bonding electrons on a UV/Vis absorption spectrum. Evaluate the utility of UV/Vis spectroscopy as a qualitative and quantitative method. Application of correct Woodward-Fieser rules to calculate wavelength of maximum absorption of organic compounds.	3	2	1	1		3	2	2
CO2	Comprehension of factors affecting vibrational, frequencies, vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, acids, anhydrides, interpret and assign IR spectroscopic data as a tool for structural elucidation.	3	2	1	1		3	2	2
CO3	Argue how nuclear spins are affected by a magnetic field, and be able to explain what happens when radiofrequency radiation is absorbed. Identify the number of proton and carbon NMR signals expected from a compound given its structure, splitting pattern in the proton NMR spectrum of a compound given its structure, to assign peaks with the aid of a chart of chemical shifts from 1H and 13C NMR in an NMR spectrum to specific protons and carbons in a compound.	3	2	1	1		3	2	2
CO4	Become familiar with the mass spectrometric technique, different types of ionization techniques and sketch components of a mass spectrometer and functions of each. Application of a mass spectrometric technique, distinguish fragmentation methods. Interpretation of mass spectra	3	2	1	1		3	2	2
CO5	Comprehension of principle, instrumentation, interferences and Sample preparation, Applications of AAS	3	2	2	2	1	3	2	2

3 Strong contribution, 2 Average contribution , 1 Low contribution

12.Brief description of self-learning /E-learning component

1. https://www.youtube.com/watch?v=tbUx-RaZS7M
2. https://nptel.ac.in/courses/103108139/
3. https://nptel.ac.in/courses/104108078/
4. https://nptel.ac.in/courses/102101050/
5. https://www.youtube.com/watch?v=xOKoVOMKHN8

13. Books recommended:

1. Introduction to spectroscopy: Pavia, Lampman & Kriz, 3rd Ed, Books/cole.
2. Spectroscopic methods in organic chemistry: H. Williams and Ian fleminig, V EditionTata Mc Grawhills
3. Organic spectroscopy: William Kemp, 3rd Edition, Palgrave publications.
4. Fundamentals of Analytical chemistry, Douglas A. Skoog, Donald M. West, F. James Holler, 7th edition, Harcourt college publications.

1. Name of the Department: Chemistry						
2. Course Name	**CHEMISTRY LAB PRACTICAL-1**			**L**	**T**	**P**
3. Course Code	**CH419**			0	0	8
4. Type of Course (use tick mark)				**Core (√)**	**DE ( )**	**FC ( )**
5. Pre-requisite (if any)	B.Sc. with Chemistry	**6. Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ( )	Every Sem ( )
7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 00		**Tutorials = 00**		**Practical = 08**		

8. COURSE OBJECTIVES: To develop practical and technical skills for better understanding of theory. To develop transferrable skills and enhancing communication skills of students.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Perform accurate and precise analysis in the field of industrial chemistry.
CO2	Able to examine water quality parameters (DO, COD, BOD and TDS) and argue about water quality.
CO3	Explain the principles of chromatographic techniques, UV spectroscopy and viscosity measurements.
CO4	Organize the records of all performed experiments in the manner which is required in laboratory.
CO5	Analyze the importance of personal safety and care of equipments and chemicals.

10. List of experiments

1. To determine the percentage composition of the given mixture consisting of two liquids A and B by viscositymethod.
2. To determine the relative surface tension of a liquid byStalagnometer.
3. To determine the molecular weight of non-volatile solute cryscopically using water assolvent.
4. Selective extraction of iron metal cation from mixture of iron and magnesium for determination of their respectiveconcentration.
5. Paper chromatography separation of metalion.
6. Determination of copper and nickel in thegivensample.
7. Separation of amino acid by thinlayerchromatography.
8. Separation of mixture of carbohydrate by thin layerchromatography.
9. Separation of mixture of dyes by columnchromatography.
10. Oxime and 2, 4 dinitrophenylhydrazone ofaldehyde/ketone.
11. Determination of Dissolved Oxygen (D.O.) in the given watersample.
12. Determination of Conductivity of the watersample.
13. Determination of Total Dissolved Solid (T.D.S.) in the given watersample.
14. Determination of concentration of KMnO4 by UV-VisibleSpectrophotometer.
15. Determination of iron content in the given water sample by UV-VisibleSpectrophotometer.
16. Determination of Chlorophyll in olive oil by UV-Visible Spectroscopy.
17. Separation of plant pigment from green leaves by columnchromatography.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Perform accurate and precise analysis in the field of industrial chemistry.	**3**	**2**	**2**	**1**	**3**	**3**	**3**	**2**
CO2	Able to examine water quality parameters (DO, COD, BOD and TDS) and argue about water quality	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	Explain the principles of chromatographic techniques, UV spectroscopy and viscosity measurements.	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**2**
CO4	Organize the records of all performed experiments in the manner which is required in laboratory.	**3**	**3**	**2**	**2**	**3**	**1**	**3**	**2**
CO5	Analyze the importance of personal safety and care of equipments and chemicals.	**3**	**1**	**2**	**2**	**3**	**3**	**3**	**2**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self- learning / E-learning component

1. https://www.fondriest.com/environmental-measurements/measurements/measuring-water-quality/dissolved-oxygen-sensors-and-methods/
2. http://www.nsec.ac.in/images/bes_Viscosity%20of%20Sugar%20Solution.pdf
3. https://www.youtube.com/watch?v=8wmQ_xWqZbo
4. https://www.youtube.com/watch?v=kXI_Om-2XYk
5. https://www.youtube.com/watch?v=YBeZZwNSeb8
6. https://www.youtube.com/watch?v=WBYop48A4gM
7. https://www.youtube.com/watch?v=V16USbjKZXw

13. Books recommended:

1. Advance Practical Chemistry: Jagdamba Singh, L.D.S Yadav, Jaya Singh, I.R. Siddiqui, PragatiEdition.
2. Practical Organic ChemistryA.I.Vogel.
3. Practical Physical Chemistry : B. Viswanathan and P.S.Raghavan.
4. Experimental Inorganic Chemistry –W.G.Palmer.

SEMESTER-II

1.Name of the Department: Chemistry						
2.Course Name	**MODERN INSTRUMENTAL METHODS OF ANALYSIS AND COMPUTATIONAL TECHNIQUES**			**L**	**T**	**P**
3.Course Code	**CH408**			3	1	0
4.Type of Course (use tick mark)				**Core(√)**	**DE( )**	**FC( )**
5.Pre-requisite (if any)	B.Sc. with Chemistry	**6.Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ( )	EverySem( )
7.Total Number of Lectures, Tutorials, Practicals						
Lectures=30		**Tutorials=10**		**Practical=Nil**		

8. COURSE OBJECTIVES: This course is designed for postgraduate students of chemistry and industrial chemistry as a broad base introduction to analytical instrumentation techniques for the measurement of different chemical and physical properties of compounds and materials (composition, structure, etc.). After successfully completion of course, the student will able understand the working principal and applications of various modern analytical techniques as well as their operation.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Students would able to analyze the data by applying different type of statistical methods and would also understand the different between systematic and random errors.
CO2	Students evaluate fundamentals of electrochemistry and recognize the electrochemical processes. They got sound inside of different type of polarographic and voltammetric methods and their applications.
CO3	Students would develop the concept of thermogravimetric analysis, differential analysis and differential scanning calorimetry methods and their applications.
CO4	Students would restate difference between different modes of chromatographic separation; apply knowledge of qualitative and quantitative analysis in various fields of chemical, pharmaceutical industry etc.
CO5	Students would able to illustrate how the computer and software are used in analytical laboratory and got springboard for further study.

10.Unit wise detailed content

Unit-1	**Number of lectures=08**	**Title of the unit: Errors and Evaluation**

Definition of terms mean and median, precision, standard deviation, relative standard deviation, accuracy, absolute error, relative error, types of error in experimental data, determinate (systematic), indeterminate (random) and gross, sources of errors and their effects upon the analytical results, statistical evaluation of data-normal distribution, interval estimation, methods of least squares.

Unit-2	**Number of lectures= 08**	**Title of the unit: Polarographic Techniques and Voltammetry**

Polarography; Theory, Instrumentation and its working; Advantages of using dropping mercury electrode, Derivation of Ilkovic equation, Factors affecting the limiting current, The half wave potential, Criterion of reversibility, Applications of polarography, Square-wave polarography, Differential pulse polarography and cyclic voltammetry showing cyclic voltammetric excitation.

Unit-3	**Number of lectures=08**	**Title of the unit: Thermal Methods**

Thermogravimetric analysis, Instrumentation and Applications, Differential thermal analysis, General principles and applications with special reference to polymers; Differential scanning calorimetry, Theory and different types of thermal scanning calorimetry, Instruments, Power compensated DSC instrument, Heat flux DSC instrument and modulated DSC instrument, DSC data analysis and applications.

Unit-4	**Number of lectures=08**	**Title of the unit: Chromatography**

Chromatographic mechanism, Classification of chromatography, principles, types, techniques of column chromatography and techniques of elution, thin layer chromatography, Gas chromatography, Applications of gel permeation and ion exchange chromatography. Introduction of HPLC, instrumentation, reverse phase HPLC, industrial applications of HPLC.

Unit-5	**Number of lectures=08**	**Title of the unit: Computer application**

Elements of computer system set-up, components of computer system, generation of computer and computer languages, personnel computers, PC-software packages, an introduction, disk operating system and windows, text processing software, introduction to a spreadsheet software, creation of spreadsheet software, creation of spreadsheet applications, range, formulas, function, data base functions in spreadsheets, graphics on spreadsheet, presentation graphics, creating a presentation on a PC, data communications, networking: Lan & Wans, software system, softw are development process, file design & report design, Data files: types/organization, master & transaction file, relevance of database management systems and integration of applications, basic of data processing, flow charting, input-process- output analysis, report generation and label generation.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Students would able to analyze the data by applying different type of statistical methods and would also understand the different between systematic and random errors.	**3**	**1**	**1**		**2**	**3**	**2**	**3**
CO2	Students evaluate fundamentals of electrochemistry and recognize the electrochemical processes. They got sound inside of different type of polarographic and voltammetric methods and their applications.	**3**	**1**	**1**		**1**	**3**	**2**	**3**
CO3	Students would develop the concept of thermogravimetric analysis, differential analysis and differential scanning calorimetry methods and their applications.	**3**	**1**	**1**		**1**	**3**	**2**	**2**
CO4	Students would restate difference between different modes of chromatographic separation; apply knowledge of qualitative and quantitative analysis in various fields of chemical, pharmaceutical industry etc.	**3**	**2**	**1**		**2**	**3**	**1**	**2**
CO5	Students would able to illustrate how the computer and software are used in analytical laboratory and got springboard for further study.	**3**	**2**	**1**		**3**	**3**	**1**	**2**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12.Brief description of self-learning /E-learning component

1. https://www.youtube.com/watch?v=HEgl0JyX80U
2. https://www.youtube.com/watch?v=d1vv7ww8xtA
3. https://www.youtube.com/watch?v=NzbDEjI8IKE
4. https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod5.pdf
5. https://www.youtube.com/watch?v=Cu_WeVyOaHI

13. Books recommended:

1. Fundamentals of Analytical chemistry, Douglas A. Skoog, Donald M. West, F.James Holler, 7th edition, Harcourt college publications.
2. Principles and practice of analytical chemistry, F. W. Fifield, D. Kealey, 5th edition, Blackwell publication.
3. Analytical chemistry, Gary D. Christian, 6th edition, Wiley and sons publication.
4. Basic concepts of analytical chemistry, S. M. Kopper, New Age International Publishers.

1. Name of the Department: Chemistry						
2. Course Name	CHEMISTRY OF NATURAL PRODUCTS			L	T	P
3. Course Code	CH409			3	1	0
4. Type of Course (use tick mark)				Core (√)	DE ( )	FC ( )
5. Pre-requisite (if any)	B.Sc. with Chemistry	6. Frequency (use tick marks)	Even (√)	Odd ( )	Either Sem ( )	Every Sem ( )

7. Total Number of Lectures, Tutorials, Practicals

Lectures = 30	Tutorials = 10	Practical = Nil

8. COURSE OBJECTIVES: Students gain the knowledge of secondary plant metabolites such as terpenoids, alkaloids, carbohydrates, Amino Acid, Peptides & Proteins, steroids, Synthesis and medicinal uses of; caffeine, theophylline, theobromine andPhytopharmaceuticals.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Create the concept of secondary plant metabolites; terpenoids and its general methods of structure determination, isoprene rule; Stereochemistry, constitution and synthesis of Citral and Menthol.
CO2	Evaluate the general method of isolation, structure elucidation of alkaloid, specially based on nitrogen heterocyclic ring (Hofmann's exhaustive methylation, Emde's degradation and Von Braun's method).
CO3	Analyze general reactions, constitution of glucose & fructose; Conformations of monosaccharide's. Stereochemistry and configuration of the nucleus of steroids.
CO4	Know about, classification, general method of preparation, properties and reactions of amino acids, general method of synthesis & determination of structure of polypeptides. Primary, secondary, tertiary & quaternary structure ofproteins.
CO5	Understand the Synthesis and medicinal uses of; caffeine, theophylline, theobromine. Phytopharmaceuticals: Recent development and commercialization of plant derived natural products. Strategies for rapid identi fication of novel therapeutic leads from natural products.

10. Unit wise detailed content

Unit-1	Number of lectures = 08	Title of the unit: Terpenoids

Introduction, nomenclature, occurrence, general properties, classification, isolation and general methods of structure determination of terpenoids, isoprene rule; Stereochemistry,constitutionandsynthesisofCitralandMenthol.Carotenoids;Introduction,classification,isolationandgeneralmethodofstructuredeterminationof carotenoids.

Unit-2	Number of lectures =08	Title of the unit: Alkaloids

Introduction,nomenclature,classification,isolation,physiologicalaction,occurrenceandgeneralmethodsofstructureelucidationofalkaloid,specia llybasedonnitrogen heterocyclic ring (Hofmann's exhaustive methylation, Emde's degradation and Von Braun's method).

Unit-3	Number of lectures = 08	Title of the unit: Carbohydrates & Steroids

Introduction,classification,generalreactions,constitutionofglucose&fructose;Conformationsofmonosaccharide's.Steroids;Introduc tion,Diel'shydrocarbon, nomenclature, stereochemistry and configuration of the nucleus of steroids.

Unit-4	Number of lectures = 08	Title of the unit: Amino Acid, Peptides & Proteins

Introduction,nomenclature,classification,generalmethodofpreparation,propertiesandreactionsofaminoacids.Introduction,occurrenc e,nomenclature,general method of synthesis & determination of structure of polypeptides. Primary, secondary, tertiary & quaternary structure of proteins.

Unit-5	Number of lectures = 08	Title of the unit: Phytopharmaceuticals

Synthesis and medicinal uses of; caffeine, theophylline, theobromine. Phytopharmaceuticals: Recent development and commercialization of plant derived natural products. Strategies for rapid identification of novel therapeutic leads from natural products.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Create the concept of secondary plant metabolites; terpenoids and its general methods of structure determination, isoprene rule; Stereochemistry, constitution and synthesis of Citral and Menthol.	3	1	2	1		2	2	2
CO2	Evaluate the general method of isolation, structure elucidation of alkaloid, specially based on nitrogen heterocyclic ring (Hofmann's exhaustive methylation, Emde's degradation and Von Braun'smethod).	3	1	2	1		2	2	2
CO3	Analyze general reactions, constitution of glucose & fructose; Conformations of monosaccharides. Stereochemistry and configuration of the nucleus of steroids.	3	1	2	1		2	2	2
CO4	Know about, classification, general method of preparation, properties and reactions of amino acids, general method of synthesis & determination of structure of polypeptides. Primary, secondary, tertiary &quaternary structure of proteins.	3	1	2	1		2	1	2
CO5	Understand the Synthesis and medicinal uses of; caffeine, theophylline, theobromine. Phytopharmaceuticals: Recent development and commercialization of plant derived natural products. Strategies for rapid identification of novel therapeutic leads from natural products.	3	1	2	1		2	2	2

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self-learning / E-learning component

1. https://www.intechopen.com/books/terpenes-and-terpenoids/introductory-chapter-terpenes-and-terpenoids
2. https://www.intechopen.com/books/alkaloids-their-importance-in-nature-and-human-life/introductory-chapter-alkaloids
3. https://study.com/academy/lesson/steroids-structure-function.html
4. http://chemistry.creighton.edu/~jksoukup/lec5-aminoacidsSTUD.pdf
5. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/127106009/lec4.pdf

13. Books recommended:

1. Natural products: Chemistry and Biological Significance, J.Mann, R.S.Davidson,J.B.Hobbs,d.V. Banthrope and B.Harborne, Longman,Essex.
2. Organic Chemistry, Vol 2, I. L. Finar, ELBS.
3. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta Anda. Marston, Harwood Academic Publishers.
4. Chemistry of natural products, S.V.Bhat, B.A.Nagasampagi, M. Sivakumar.
5. Natural products from plants, Peter B. Kaufman, Leland J. Creke, Sara Warber, James A. Dupe, Harry L. Brielmann ,CRC publication
6. Organic chemistry of natural products, Vol. I and II , Gurdeep Chatwal, Himalya Publishing house.

1. Name of the Department: Chemistry						
2.Course Name	**CORROSION, LUBRICATION AND PAINT TECHNOLOGY**			**L**	**T**	**P**
3.Course Code	**CH410**			3	1	0
4.Type of Course (use tick mark)				**Core(√)**	**DE( )**	**FC( )**
5.Pre-requisite (if any)	B.Sc. with Chemistry	**6.Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ( )	EverySem( )
7.Total Number of Lectures,Tutorials,Practicals						
Lectures=30		**Tutorials=10**		**Practical=Nil**		

8. COURSE OBJECTIVES: Main objective includes deep understanding of mechanism of corrosion, lubrication and action of lubricants, properties, constituents and formulation of industrial paints, dyes and varnishes.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Explain the theories and mechanisms of corrosion. Describe, identify, analyze, and compare different corrosion types. Formulate industry relevant surface treatment methods for metals and alloys and corrosion protection strategies.
CO2	Comprehension of the fundamentals of lubricants, lubrication and the lubricants operating requirements, relationship with the lubrication requirements, as well as on the lubricants properties. Know how to recommend a lubricant and how to identify the causes of in-service issues and their solutions, defend the selection of an appropriate lubricant for perfect lubrication.
CO3	Describe the ingredients and characteristics of paint. Evaluate the properties (adhesion, hardness, thickness, extent of cure, etc.) of the cured film. Will be familiar with the composition of paints and coatings and modern technologies used in the preparation of paint/coatings formulations.
CO4	Comprehension of properties, constituents and formulations of pigments and dyes, differentiate dyes and pigments, their mechanisms of action and applications.
CO5	Comprehensive understanding of properties, constituents, formulations and uses of varnishes. Develop an appropriate choice of coating material (paint, pigment, dye or varnish) based on the nature of the substrate.

10.Unit wise detailed content

Unit-1	**Number of lectures=08**	**Title of the unit: Corrosion**

Introduction to corrosion, cause of corrosion, Theories of Corrosion, Mechanism of Electrochemical or Wet corrosion, dry corrosion, Factors influencing corrosion; Types of corrosion- Galvanic corrosion, Erosion Corrosion, Crevice corrosion, Pitting corrosion, Intergranular corrosion, Waterline Corrosion, Stress corrosion, Microbiological corrosion, Fatigue Corrosion, Fretting Corrosion; Protection from corrosion: Design and Material selection, Cathodic & Anodic protection, Corrosion inhibitors, Passivity, Galvanizing, Tinning and Electroplating, Pourbiax (P^H potential) diagram

Unit-2	**Number of lectures=08**	**Title of the unit: Lubrication**

Introduction, Friction and wear, Lubricants, Theories of Friction, Lubrication and wear, Mechanism of lubrication- Fluid or Hydrodynamic; lubrication, Boundary and extreme pressure lubrication; Classification of lubricants: Solid, Semisolid, Synthetic lubricants, lubricating oils - vegetable oils, animal oils, mineral oils, blended oils, lubricating emulsion, greases; Properties of lubricating oils, cutting fluids, selection of lubricants.

Unit-3	**Number of lectures=08**	**Title of the unit: Paint Technology**

Introduction to paint, ingredient and classification; Essential concepts of paint formulation, formulation of coating for mas onry, steel work, aircrafts, automobile, distempers, etc., Failure of paint film; Testing and evaluation tests of liquids films, dry films, performance and weathering test, world standard specification for paints and materials.

Unit-4	**Number of lectures=08**	**Title of the unit: Pigments and Dyes**

Introduction to pigments, general and physical properties; Preparation, properties and uses of Black pigment (Carbon black), Yellow pigment (chrome yellow), Red pigment (Red lead), Green pigment (Chrome green), White pigment (ZnO), Blue pigment (Ultramarine blue); Properties of Coating, solvent plasticizers Dyes: Introduction, Classification, Methods of dyeing, Basic operations in dyeing, Study of Phenolphthalein, Methyl orange and Crystal violet. Difference between pigment and dye.

Unit-5	**Number of lectures=08**	**Title of the unit: Varnishes**

Introduction to varnishes, physical properties of varnishes; Constituents of varnishes, classification and formulation of industrial varnishes; Characteristics of good varnish; Applications of varnish.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Explain the theories and mechanisms of corrosion. Describe, identify, analyze, and compare different corrosion types. Formulate industry relevant surface treatment methods for metals and alloys and corrosion protection strategies.	**3**	**2**	**2**	**2**		**2**	**2**	**2**
CO2	Comprehension of the fundamentals of lubricants, lubrication and the lubricants operating requirements, relationship with the lubrication requirements, as well as on the lubricants properties. Know how to recommend a lubricant and how to identify the causes of in-service issues and their solutions, defend the selection of an appropriate lubricant for perfect lubrication.	**3**	**2**	**2**	**2**		**2**	**1**	**2**
CO3	Describe the ingredients and characteristics of paint. Evaluate the properties (adhesion, hardness, thickness, extent of cure, etc.) of the cured film. Will be familiar with the composition of paints and coatings and modern technologies used in the preparation of paint/coatings formulations.	**3**	**2**	**2**			**2**	**1**	**2**
CO4	Comprehension of properties, constituents and formulations of pigments and dyes, differentiate dyes and pigments, their mechanisms of action and applications.	**3**	**2**	**1**			**1**	**2**	**2**
CO5	Comprehensive understanding of properties, constituents, formulations and uses of varnishes. Develop an appropriate choice of coating material (paint, pigment, dye or varnish) based on the nature of the substrate.	**3**	**2**	**1**			**1**	**1**	**2**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12.Brief description of self-learning /E-learning component

1. https://www.youtube.com/watch?v=5OxdXq91TV0
2. https://www.youtube.com/watch?v=WQ8v-UcACTE
3. https://www.youtube.com/watch?v=Keff0zA7Zq8
4. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/116102052/lec3.pd
5. https://www.oreilly.com/library/view/basic-civil-engineering/9788131729885/xhtml/chapter010.xhtml

13. Books recommended:

1. Friction and Lubrication of Solids - Bowden, F.P. and D. Tabor Part I & II Clare-don Press, Oxford (1954)
2. An Introduction to Metallic Corrosion – 3rd Ed., Ulick R. Evans, Edward Arnold Ltd. And ASM (1981)
3. Corrosion and Corrosion Control 3rd Ed., H.H. Uhling & R.Winston Revie, Wiley- Inter Sciences, New York (1985)
4. Corrosion Engineering, 3rd, Ed., M.G. Fontana, McGraw Hill, New York (1986).

1. Name of the Department: Chemistry						
2. Course Name	PHARMACEUTICAL CHEMISTRY			L	T	P
3. Course Code	CH411			3	1	0
4. Type of Course (use tick mark)				Core (√)	DE ( )	FC ( )
5. Pre-requisite (if any)	B.Sc. with Chemistry	6. Frequency (use tick marks)	Even (√)	Odd ( )	Either Sem ( )	Every Sem ( )

7. Total Number of Lectures, Tutorials, Practicals		
Lectures = 30	Tutorials = 10	Practical = Nil

8. COURSE OBJECTIVES: Students to understand the Synthesis, uses and mode of action of Antibiotics and Sulpha Drugs ,Antipyretics analgesics, Anesthetic drugs, cardiovascular drugs, Drug Design.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Evaluate the concept of antibiotics. Classification, synthesis, mode of action and uses of different types of antibiotics.
CO2	Analyze classification, structure, synthesis and uses of analogues of p-aminophenol, Salicylic acid, Pyrazolones and Pyrazolodinones.
CO3	Create the basic knowledge, Classification, Synthesis and mode of action of Inhalation, Intravenous anesthetics and Basal anesthetics.
CO4	Analyze classes, structure, synthesis and mode of action of cardiac glycosides Digoxin, and Digitoxin; Anti-hypertensive and hypotensive drugs, Antiarrhythmic agents.
CO5	Comprehension of analogues and prodrugs; concept of lead; factors governing drug design; rational approach to drug design; revolutions in drug discovery, research and development strategies.

10. Unit wise detailed content

Unit-1	Number of lectures = 08	Title of the unit: Antibiotics and Sulpha Drugs

Introduction and classification of antibiotics; beta lactam antibiotics: penicillins, its structure and mode of action, synthesis of Penicillin-v. Cephalosporins: classification, structure and mode of action of first, second, third and fourth generation cephalosporins. Aminoglycoside antibiotics: structure and mode of action of Streptomycin, Neomycin and Kenamycin. Chloramphenicol: its structure, synthesis and mode of action. Synthesis and uses of sulphathiazole, sulphaguanidine, sulphadiazine, sulphamethazine and sulphaacetamide.

Unit-2	Number of lectures =08	Title of the unit: Antipyretics analgesics

Introduction,classification,structure,synthesisandusesofanalogues ofp-aminophenol:Paracetamol,Phenacetinandantifebrin;Salicylicacidanalogues:Aspirin,Salol, Salsalate and benorilate; Pyrazolones and Pyrazolodinones analogues: Antipyrine, Aminopyrin, Dipyrone, Phenylbutazone, Oxyphenbutazone and Sulphinpyrazone

Unit-3	Number of lectures = 08	Title of the unit: Anesthetic drugs

Introduction, Classification, Synthesis and mode of action of; Inhalation anesthetics: Vinyl ether, Cyclopropane and Fluoroxene; Intravenous anesthetics: Thiopental Sodium&MethohexitalSodium;Basalanesthetics:Procaninehydrochloride,Tetracainehydrochloride,Butacainehydrochloride,Benzaminehydrochlorideand Pyrocanine hydrochloride.

Unit-4	Number of lectures = 08	Title of the unit: Cardiovascular drugs

Introduction, classification, structure and mode of action of cardiac glycosides Digoxin, and Digitoxin; Anti-hypertensive and hypotensive drugs: structure, synthesis and modeofactionofLosartan,Clonidine,Hydralazine,MethyldopaandDiazoxide;Antiarrhythmicagents:structure,synthesisandmodeofactionofDiisopyramide, Procainamide, Propranolol, Beritylium Tosilate;Vasopressor drugs: structure, synthesis and mode of action of Isoxsupurine, Pr enyl amine.

Unit-5	Number of lectures = 08	Title of the unit: Drug Design

Introduction; analogues and prodrugs; concept of lead; factors governing drug design; rational approach to drug design; Drug design: the method of variation; Drug design and development: preamble, revolutions in drug discovery, research and development strategies.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Evaluate the concept of antibiotics. Classification, synthesis, mode of action and uses of different types of antibiotics.	3	1	2	2	2	3	2	2
CO2	Analyze classification, structure, synthesis and uses of analogues of p-aminophenol, Salicylic acid, Pyrazolones and Pyrazolodinones.	3	1	2	2	2	3	2	2
CO3	Create the basic knowledge, Classification, Synthesis and mode of action of Inhalation, Intravenous anesthetics and Basal anesthetics.	3	1	2	2	2	3	2	2
CO4	Analyze classes, structure, synthesis and mode of action of cardiac glycosides Digoxin, and Digitoxin; Anti-hypertensive and hypotensive drugs, Antiarrhythmic agents.	3	1	2	2	2	3	3	2
CO5	Comprehension of analogues and prodrugs; concept of lead; factors governing drug design; rational approach to drug design; revolutions in drug discovery, research and development strategies.	3	1	2	2	2	3	2	2

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self-learning / E-learning component

1. https://www.youtube.com/watch?v=NGwP471sehI
2. https://www.youtube.com/watch?v=Ac6yMWno6yk
3. https://www.youtube.com/watch?v=-UD0y4jdKuc
4. http://nptel.ac.in/courses/104101006/downloads/lecture-notes/mod10/lec3.pdf
5. https://www.youtube.com/watch?v=2vLDzMSo2Tc&list=PLg8Xhs-vwgxLSKf7XRqynIrY6aGHseZry&index=43

13. Books recommended:

1. Burger's Medicinal Chemistry: Mangrove E. Wolff, 4th Edition, John Wiley and Sons
2. Medicinal Chemistry by Asutosh Kar , New Age International publication
3. Principles of Medicinal Chemistry: W.O.Foye.
4. The Pharmacological Basis of Theraputics : L.S. Goodman and A.Gilman
5. Wilson's Medicinal Chemistry The Organic Chemistry of Drug Synthesis: D. Lednicer and L.A.Mitscher

1.Name of the Department: Chemistry						
2.Course Name	**SURFACE CHEMISTRY AND ELECTROCHEMISTRY**			**L**	**T**	**P**
3.Course Code	**CH420**			3	1	0
4.Type of Course (use tick mark)				**Core(√)**	**DE( )**	**FC( )**
5.Pre-requisite (If any)	B.Sc. with Chemistry	**6.Frequency(usetickmarks)**	Even (√)	Odd ()	Either Sem ( )	Every Sem( )
7.Total Number of Lectures, Tutorials, Practicals						
Lectures=30		**Tutorials=10**		**Practical=Nil**		

8. COURSE OBJECTIVES: Students gain the knowledge of secondary plant metabolites such as terpenoids, alkaloids, carbohydrates, Amino Acid, Peptides & Proteins, steroids, Synthesis and medicinal uses of; caffeine, theophylline, theobromine and Phytopharmaceuticals.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Students would develop concept of monolayer and multilayer adsorption; perceive the different theory of adsorption *viz*, Langmuir, Freundlich and Gibbs adsorption isotherm and their applications. They also got insight the importance of various techniques to characterize surface of different system.
CO2	Students would able to recognize the role of surface active reagents and thermodynamics of micellization, stabilization, microemulsion, reverse micelles and get sound insight of potential develop between solid and liquid i.e. zeta potential.
CO3	Students would able to differentiate between ionic and molar conductivity for strong and weak electrolyte and understand the concept of electrical double layer and Butler –Volmer equation.
CO4	Students would able to distinguish difference between galvanic and electrolytic cell; perceive the concept of Nernst equation and thermodynamics of electrochemical cell. They also got the sound understanding of polarization and overvoltage.
CO5	Students would able to understand the role of electrochemistry for analysis of corrosion phenomenon and identify the different electrochemical energy resources.

10.Unit wise detailed content

Unit-1	Number of lectures=08	Title of the unit: Process at Solid Surface

Growth and structures of solid surfaces, Physisorption and Chemisorption, Freundlich, Langmuir and BET isotherms, Gibbs Adsorption isotherm, dissociative adsorption, temperature dependence of adsorption, sticking probability. Surface analytical techniques, spectroscopies (Auger, photoelectron and vibrational) temperature programmed techniques, Surface imaging electron microscopy.

Unit-2	Number of lectures=08	Title of the unit: Surface and Interface

Surface active reagents, classification of surface active reagents, micellization, hydrophobic and hydrophilic interaction, critical micelle concentration(CMC), kraft temperature, factors affecting CMC of surfactant, counter ion binding to micelle, thermodynamics of micellization, stabilization, microemulsion, reverse micelles, surface films(electrokinetics phenomenon) Zeta potential.

Unit-3	Number of lectures=08	Title of the unit: Conductance and Ionization

Ionic conductance, drift speed, electrical force, molar conductivity, strong and weak electrolytes and their molar conductance, law of independent migration of ions: Kohlraush's law, Ostwald's dilution law, conductometric and potentiometric titrations. Electrical double layer, ficks first and second law of diffusion, Tafel plot, process at electrode-Butler-Volmer equation and its applications.

Unit-4	Number of lectures=08	Title of the unit: Electrochemical Cells

Daniell reversible and irreversible cells, cell representations and half cell reactions, E.M.FF., Thermodynamics of electrochemical systems: Nernst equations, varieties of electrodes, standard electrode potential. Type of boundary between half cell and liquid junction potentials, Concentration cells, Applications of EMF measurements-determination of activity coefficient, composition of complex ions, solubility products, measurement of pH and pKa (Hydrogen, Quinhydrone, Glass electrodes), Polarization, Overvoltage.

Unit-5	Number of lectures=08	Title of the unit: Corrosion and Conversion of Electrochemical Energy

Introduction, definition and types, mechanism of electrochemical corrosion, methods of prevention of corrosion , dry cells, lead batteries, alkaline cells (Edison cell), Fuel cells, Biological energy and conversions.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Students would develop concept of monolayer and multilayer adsorption; perceive the different theory of adsorption *viz*, Langmuir, Freundlich and Gibbs adsorption isotherm and their applications. They also got insight the importance of various techniques to characterize surface of different system.	**3**	**1**	**3**	**1**		**3**	**3**	**3**
CO2	Students would able to recognize the role of surface active reagents and thermodynamics of micellization, stabilization, microemulsion, reverse micelles and get sound insight of potential develop between solid and liquid i.e. zeta potential	**3**	**1**	**3**	**1**		**3**	**2**	**3**
CO3	Students would able to differentiate between ionic and molar conductivity for strong and weak electrolyte and understand the concept of electrical double layer and Butler –Volmer equation.	**3**	**1**	**2**	**1**		**3**	**2**	**2**
CO4	Students would able to distinguish difference between galvanic and electrolytic cell; perceive the concept of Nernst equation and thermodynamics of electrochemical cell. They also got the sound understanding of polarization and overvoltage.	**3**	**1**	**2**	**1**		**2**	**1**	**3**
CO5	Students would able to understand the role of electrochemistry for analysis of corrosion phenomenon and identify the different electrochemical energy resources.	**3**	**1**	**3**	**1**		**2**	**2**	**3**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12.Brief description of self learning/E-learning component

1. https://nptel.ac.in/content/storage2/courses/103103026/pdf/mod2.pdf
2. https://www.youtube.com/watch?v=zdhDei1JoII
3. https://www.youtube.com/watch?v=R2UhAdqiXbs
4. http://www.umich.edu/~chem260/fall01/lecture37.pdf
5. http://www.griet.ac.in/nodes/EC_UNIT_2.pdf

13. Books recommended:

1. Bard A J Faulkner LR , Electrochemical Methods: Fundamentals and APPLICATIONS 2nd Edition John Willy & Sons New York 2002.
2. Bockris J O M, Reddy A K N, Modern Electrochemistry 1: Ionic 2nd Edition Springer 1998.
3. Atkins P, Paula J Diver and Atkins Physical Chemistry 8th Edition Oxford 2016.
4. Puri, Sharma, L.R., and Pathania, M.S.,Principles of Physical Chemistry 50th Edition, Vishal publishing Co.

1.Name of the Department: Chemistry						
2.Course Name	**COORDINATION AND ORGANOMETALLIC CHEMISTRY OF TRANSITION ELEMENTS**			**L**	**T**	**P**
3.Course Code	**CH421**			3	1	0
4.Type of Course(use tick mark)				**Core(√)**	**DE( )**	**FC( )**
5.Pre-requisite (if any)	B.Sc. with Chemistry	**6.Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ( )	EverySem( )
7.Total Number of Lectures,Tutorials,Practicals						
Lectures=30		**Tutorials=10**		**Practical=Nil**		

8. COURSE OBJECTIVES: Students gain the knowledge of secondary plant metabolites such as terpenoids, alkaloids, carbohydrates, Amino Acid, Peptides & Proteins, steroids, Synthesis and medicinal uses of; caffeine, theophylline, theobromine and Phytopharmaceuticals.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Students will have a firm foundation in the approaches of fundamental atomic structure and the periodicity of transition elements in the periodic table.
CO2	Students will have a firm foundation in have a basic understanding of nomenclature for transition metal complexes, chelate / chelation, MoT of the octahedral complxes, prediction of molecular geometries of selected molecular species.
CO3	Students will have a firm foundation in have a basic understanding of magnetism of the complexes.
CO4	Students will be able understand the knowledge in fundamentals of organometallic compounds.
CO5	Students will be able to create the pathways for the organometallic compounds as industrial catalytic applications in the various organic synthesis.

10.Unit wise detailed content

Unit-1	Number of lectures=08	Title of the unit: Basics of Coordination Chemistry

General characteristics properties of transition elements werner's theory effective atomic number shape of d orbitals bonding in transition metal complexes nomenclature of coordination compounds isomerism in coordination compounds polymerization ionisation hydrate linkage coordination position isomerism stereoisomerism geometrical and optical isomerism.

Unit-2	Number of lectures=08	Title of the unit: d-Block Metal Chemistry

valence bond theory and hybridization crystal field theory and splitting TD and c4 v system spectrochemical series and effect of covalency Crystal Field stabilization energy high and low spin octahedral complexes John teller distortion that crystal field and the square planar Crystal Field crystal field theory uses and limitation microstates and term symbols Russell saunders coupling i.e spin orbit coupling ground state of element with z=1-10 , spin Crossover.

Unit-3	Number of lectures=08	Title of the unit: Bonding and Properties of Complexes

High and low spin states, molecular orbital theory, octahedral complexes, nephelauxetic series back bonding involving pi donor and acceptor ligands pi in seo2 and o3 sf6 and HF to organ and tenable sugano diagram electronic absorption spectra of octahedral and tetrahedral complexes charge transfer spectra interpretation of electronic absorption spectra of use of reach parameters magnetic properties of transition metal complexes spin-orbit coupling the effect of temperature on ferromagnetism and antiferromagnetism and ferrimagnetism.

Unit-4	Number of lectures=08	Title of the unit: Organometallic Chemistry of Transition Elements

Organometallic compounds, ligand hapticity ,18 electron rule in metal carbonyls: homiletic and heteroleptic complexes synergistics effort factor affecting the magnitude of stretching frequency synthesis and structure of Fe carbonyl complexes fruits of unity reaction of organometallic compound oxidative addition reductive eliminations, Alkyl ,carbine ,alkene, alkyne,allyl and buta 1-3 diene complexes.

Unit-5	Number of lectures=08	Title of the unit: Application of Organometallic Chemistry

Application of Organometallic Chemistry:- organometallics: organolithium magnesium zinc copper and titanium reagents . Catalytic cycle of wacker process.
Homogenneuos catalysis: alkene (olefin) and alkaline metal, Wikinsons catalytic cycle, hydroformylation (oxo-process) ,
Heterogeneous catalysis: commercial application: Ziegler-Natta catalysis and haber process.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Students will have a firm foundation in the approaches of fundamental atomic structure and the periodicity of transition elements in the periodic table.	**3**	**2**	**1**	**2**	**2**	**1**	**1**	**2**
CO2	Students will have a firm foundation in the basic understanding of nomenclature for transition metal complexes, chelate / chelation, MoT of the octahedral complexes, prediction of molecular geometries of selected molecular species.	**3**	**2**	**1**	**2**	**2**	**1**	**1**	**2**
CO3	Students will have a firm foundation in basic understanding of magnetism of the complexes.	**3**	**1**	**1**	**2**	**2**	**2**	**1**	**2**
CO4	Students will be able understand the knowledge in fundamentals of organometallic compounds.	**3**	**1**	**1**	**2**	**2**	**2**	**1**	**2**
CO5	Students will be able to create the pathways for the organometallic compounds as industrial catalytic applications in the various organic syntheses.	**3**	**1**	**1**	**2**	**2**	**2**	**1**	**2**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12.Brief description of self learning/E-learning component

1. https://nptel.ac.in/courses/104/101/104101121/
2. https://nptel.ac.in/content/syllabus_pdf/104101090.pdf
3. http://www.ncert.nic.in/ncerts/l/lech109.pdf
4. https://nptel.ac.in/courses/104103022/
5. https://nptel.ac.in/courses/104103071/

13. Books recommended:

1. F. Albert cotton, Geoffrey Wikinson, Carlos A,Murillo and Manfred Bochmann. Advanced inorganic chemistry, 6th edition, wiley India Pvt LTD.
2. J.D Lee. Concise inorganic Chemistry, 5th edition, Wiley India Pvt LTD.
3. JH Huheey , inorganic chemistry- principles, structure and reactivity , Harper and Row publisher Inc . New York (1972).

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1. Name of the Department: Chemistry						
2. Course Name	**CHEMISTRY LAB PRACTICAL-2**			**L**	**T**	**P**
3. Course Code	**CH422**			0	0	8
4. Type of Course (use tick mark)				**Core (√)**	**DE ( )**	**FC ( )**
5. Pre-requisite (if any)	B.Sc. with Chemistry	**6. Frequency (use tick marks)**	Even (√)	Odd ( )	Either Sem ( )	Every Sem ( )
7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 00		**Tutorials = 00**		**Practical = 08**		

8. COURSE OBJECTIVES: Imparting of scientific methodology, Development of practical/technical skills, The ability to work effectively and safely in a laboratory environment, Developing transferable skills (team work, time management), Enhancing communication skill.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Understand the basic analytical and technical skills to work effectively in the various fields of chemistry
CO2	Able to detect adulterants in the given food sample.
CO3	Know the determination of strength of acid, optical rotation of cane sugar. Saponification value of oil, acid value of oil. Isolation of lycopene, nicotine, lactose and casein, lecithin Caffeine from tea. Preparation of Acetanilide, Aspirin, Paracetamol.
CO4	Remember to keep records of all performed experiments in the manner, which is required in laboratory.
CO5	Analyze the importance of personal safety and care of equipment's and chemicals.

10. List of experiments

1. Determination of strength of acid against strong base by pH meter.
2. Measurement of surface tension of a liquid by capillary rise method
3. Determination of optical rotation of cane sugar.
4. Determination of saponification value in the given oil.
5. Determination of acid value in the given oil.
6. Estimation of amino acid.
7. Estimation of Glucose.
8. Separation of essential oils by soxhlet extractor.
9. Isolation of Lycopene from tomato.
10. Isolation of Nicotine from tobacco.
11. Isolation of Lactose and caesin from milk.
12. Isolation of lecithin from egg yolk.
13. Isolation of Caffeine from tea.
14. Preparation of Magnesium bisilicate (antacid).
15. Preparation of Paracetamol.
16. To prepare the iron(III) ethylenediaminetetraacetalato complex, $Na[Fe(EDTA)]\cdot 3H_2O$

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understand the basic analytical and technical skills and to work effectively in the various fields of chemistry	**3**	**1**	**1**	**1**		**2**	**1**	**2**
CO2	Able to detect adulterants in the given food sample.	**3**	**1**	**3**	**1**		**3**	**3**	**2**
CO3	Know the determination of strength of acid, optical rotation of cane sugar. Saponification value of oil, acid value of oil. Isolation of lycopene, nicotine, lactose and casein, lecithin Caffeine from tea. Preparation of Acetanilide, Aspirin, Paracetamol.	**3**	**1**	**1**	**1**		**2**	**1**	**2**
CO4	Remember to keep records of all performed experiments in the manner, which is required in laboratory.	**3**	**1**	**1**	**1**		**2**		
CO5	Analyze the importance of personal safety and care of equipment's and chemicals.	**3**	**1**	**1**	**1**		**2**	**1**	**3**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self- learning / E-learning component

1. https://www.youtube.com/watch?v=MTsn1-ToKqQ
2. http://www.bellevuecollege.edu/wp-content/uploads/sites/140/2014/06/aspirin_tablets_titration.pdf
3. https://www.frontiersin.org/articles/10.3389/fonc.2015.00196/full
4. https://www.youtube.com/watch?v=1tmqUVSVPo4
5. https://www.youtube.com/watch?v=KZ35K05SA7g
6. https://www.youtube.com/watch?v=249FNCSR-Cw
7. https://www.niser.ac.in/sps/sites/default/files/basic_page/Surface%20tension%20by%20capillary%20rise%20method_%202018.pdf

13. Books recommended:

1. Advance Practical Chemistry: Jagdamba Singh, L.D.S Yadav, Jaya Singh, I.R. Siddiqui, Pragati Edition.
2. Practical Organic Chemistry A.I. Vogel.
3. Practical Physical Chemistry: B. Viswanathan and P.S. Raghavan.
4. Experimental Inorganic Chemistry –W.G.Palmer.