PERIYAR UNIVERSITY

NAAC 'A++' Grade with CGPA 3.61 (Cycle - 3)

Salem-636011, Tamilnadu, India.

SYLLABUS FOR M.Sc. ORGANIC CHEMISTRY

DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

(For candidates admitted in the colleges affiliated to Periyar University from 2023-2024 onwards)

REGULATIONS

1.OBJECTIVES OF THECOURSE:

The objectives of this course are the following:

(a) To impart knowledge in advanced concepts and applications in various fields of Chemistry.

(b) To provide wide choice of elective subjects with updated and new areas in various branches of Chemistry to meet the needs of all students.

2. COMMENCEMENT OF THIS REGULATION:

These regulations shall take effect from the academic year 2023-2024, that is, for students who are admitted to the first year of the course during the academic year 2023-2024 and thereafter.

3. ELIGIBILITY FORADMISSION:

A candidate who has passed B.Sc., Chemistry degree of this University or any other University accepted by the Syndicate equivalent thereto, subject to such condition as may be prescribed therefore are eligible for admission to M.Sc., Degree Programme and shall be permitted to appear and qualify for the Master of Science (M.Sc.) Degree Examination in Chemistry of this University.

4. DURATION OF THECOURSE:

The programme for the degree of Master of Science in Organic Chemistry shall consist of two Academic years divided into four semesters.

5. EXAMINATIONS:

The examination shall be of three hours duration for each course at the end of each semester. The candidate failing in any subject(s) will be permitted to appear in the subsequent examination.

The practical / project should be an individual work. The University examination for practical / project work will be conducted by the internal and external examiners jointly at the end of every year.

TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	**M.Sc.,ORGANIC CHEMISTRY**
Programme Code	
Duration	**PG – 2 YEARS**
Programme Outcomes (Pos)	PO1 (Scientific knowledge): Apply the knowledge of chemical science to find solutions to various academic and research problems. PO2 (Problem analysis): Identify a research problem, review research literature, and design innovative solutions for scientific problems. PO3 (Skill enhancement): Recognize and practice the required skill-sets to enhance them for future employability. PO4 (Modern tool usage): Adopt appropriate modern techniques, resources, and tools to execute the experiments and analyze and interpret the data. PO5 (Society and ethics): Implement contextual knowledge and ethical principles to assess various societal issues related to common scientific and industrial practices. PO6 (Environment and sustainability): Assess the impact of scientific approaches in environment with special emphasis on the need for sustainable development. PO7 (Individual and teamwork): Function as an individual or as a member or leader in diverse teams, and in multidisciplinary settings. PO8 (Communication): Communicate effectively, write reports and design documentation, make effective presentations, and give and receive clear instructions. PO9 (Project management): Utilize knowledge and understanding of the chemical principles to manage projects of various magnitudes in multidisciplinary environments. PO10 (Life-long learning): Identify the important aspects of Chemistry and other allied subjects for independent and life-long learning in the broader context of scientific and technological development.
Programme Specific Outcomes (PSOs)	PSO 1 understands the existence of matter in the universe as solids, liquids, and gases which are composed of molecules, atoms and sub atomic particles. PSO 2 learns to estimate inorganic salt mixtures and organic compounds both qualitatively and quantitatively using the classical methods of analysis in practical classes. PSO 3 grasps the mechanisms of different types of reactions both organic and inorganic and will try to predict the products of unknown reactions. PSO 4 synthesizes the chemical compounds by maneuvering the addition of reagents under optimum reaction conditions.

	PSO 5 gets aware and handles the sophisticated instruments/equipment and Develop research oriented skills.

Credit Distribution for PG Programme

Semester–I	Credit	Semester-II	Credit	Semester-III	Credit	Semester–IV	Credit
1.1. Core-I	5	2.1. Core-IV	5	3.1. Core-VII	5	4.1. Core-XI	5
1.2 Core-II	5	2.2 Core-V	5	3.2 Core-VII	5	4.2 Core-XII	5
1.3 Core – III	4	2.3 Core – VI	4	3.3 Core – IX	5	4.3Project with VIVA-VOCE	7
1.4 Elective (Generic / Discipline Centric)- I	3	2.4 Elective (Generic / Discipline Centric) – III	3	3.4 Core-X	4	4.4 Elective - VI (Industry / Entrepreneurship) 20% Theory 80% Practical	3
1.5 Elective (Generic / Discipline Centric)-II	3	2.5 Elective (Generic / Discipline Centric)-IV	3	3.5Elective (Generic/ Discipline Centric) – V	3	4.5 Skill Enhancement Course - Professional Competency Skill	2
		2.6 Skill Enhancement Course - I	2	3.6 Skill Enhancement Course - II	2	4.6 Extension Activity	1
		2.7Human Rights	1	3.7 Internship/ Industrial Activity	2		
	20		**23**		**26**		**23**
						Total Credit Points	**92**

Componen twise Credit Distribution

Credits	SemI	SemII	SemIII	SemIV	Total
Part A	**14**	**14**	**19**	**17**	**64**
Part B (i)Discipline– Centric/Generic Skill	**6**	**6**	**3**	**5**	**20**
(ii)Human Rights		**1**			**1**
(iii)Summer Internship/Industrial Training		**2**	**2**		**4**
Part C			**2**	**1**	**3**
Total	**20**	**23**	**26**	**23**	**92**

M.Sc., ORGANIC CHEMISTRY PROGRAMME.

Structure, course work, contact hours, credits and maximum internal and external marks for the students admitted in **2023-2024**

sem	Course	Course code	Title of the Course code	Contact Hr/Week	Credit	Int. Mark	Ext Mark	Total Mark
SEMESTER-I								
I	**CORE COURSE-I**	CHEC101	CoordinationandNuclearChemistry	7	5	25	75	100
	CORE COURSE-II	CHEC102	StereochemistryandOrganicReaction Mechanism	7	5	25	75	100
	CORE COURSE-III	CHEC103	Organic Chemistry Practical	6	4	40	60	100
	ELECTIVE COURSE-I	CHEE101	Pharmaceutical Chemistry	5	3	25	75	100
	ELECTIVE COURSE-II	CHEE102	NameReactionsin OrganicChemistry	5	3	25	75	100
				30	**20**			**500**
SEMESTER-II								
II	**CORE COURSE-IV**	CHEC204	OrganicReactionMechanism	6	5	25	75	100
	CORE COURSE-V	CHEC205	QuantumChemistryandGroupTheory	6	5	25	75	100
	CORE COURSE-VI	CHEC206	Inorganic Chemistry Practical	6	4	40	60	100
	ELECTIVE COURSE-III	CHEE203	Material Science	4	3	25	75	100
	ELECTIVE COURSE-IV	CHEE204	FunctionalGroupTransformation inOrganic Chemistry	3	3	25	75	100
	SKILL ENHANCEMENT COURSE-I (SEC-I)	CHES101	Industrial chemistry	3	2	25	75	100
	Human Rights			2	1			
				30	**23**			**600**
III	**SEMESTER-III**							
	CORE COURSE-VII	CHEC307	PhysicalMethodsin Chemistry	6	5	25	75	100
	CORE COURSE-VIII	CHEC308	Bioorganic Chemistry	6	5	25	75	100
	CORE COURSE- IX	CHEC309	Organic Chemistry Practical I DoubleStageOrganicPreparations	6	5	25	75	100
	ELECTIVE COURSE-V	CHEE305	BiologicalChemistry	3	3	25	75	100
	Core (Industry Module)-X EDC	CHEC310	(Choose from outside the department)	6	4	25	75	100
	SKILL ENHANCEMENT COURSE-II (SEC-II)	CHES202	Software Package for Chemists – Matlab, Origin and Chemdraw	**3**	**2**	**Internal Assessment**		
	INTERNSHIP / INDUSTRIAL		(Carried out in Summer Vacation at the end of I year – 30 hours)	-	2	-	-	-

	ACTIVITY							
				30	**26**			**500**
IV	**SEMESTER-IV**							
	CORE COURSE-XI	CHEC411	Orbital Symmetry, Photochemistry andNon-conventionaltechniquesinOrganic Synthesis	6	5	25	75	100
	CORE COURSE-XII	CHEC412	Chemistryof natural products	6	5	25	75	100
	PROJECT	CHEPR01	Core Project with VIVA VOCE	10	7	100	50+50	200
	ELECTIVE COURSE-VI	CHEE406	Analytical Instrumentation technique Practical (Industry Entrepreneurship)	4	3	40	60	100
	SKILL ENHANCEMENT COURSE-III (SEC-III)	CHES303	Professional Competency Skill Enhancement Course	4	2	**Internal Assessment**		
	EXTENSION ACTIVITY		Extension Activity	-	1	Performance based assessment -		
				30	**23**			**500**
			TOTAL		**92**			**2100**

1. Testing Pattern (25+75)

Internal Assessment

Theory Course: For theory courses there shall be three tests conducted by the faculty concerned and the average of the best two can be taken as the Continuous Internal Assessment (CIA) for a maximum of 25marks.The duration of each test shall be one/one and half hour.

Computer Laboratory Courses: For Computer Laboratory Oriented Courses, there shall be two tests in Theory part and two tests in Laboratory part. Choose one best from Theory part and other best from the two Laboratory part. The average of the best two can be treated as the CIA for amaximumof25marks.The duration of each test shall be one/one and a half hour.

There is no improvement for CIA of both theory and laboratory, and, also for University End Semester Examination.

Written Examination: Theory Paper (Bloom's Taxonomy based)

Question Paper Model

Intended Learning Skills	Maximum75Marks Passing Minimum: 50%Duration:ThreeHours
	Part–A(10x2 =20 Marks) Answer ALL questions Each Question carries 2 marks
Memory Recall/ Example/ Counter Example/Knowledge about the Concepts/Understanding	Two questions from each unit
	Question1to Question10
	Part– B(5x5 =25Marks) Answer ALL questions Eachquestionscarries5Marks
Descriptions/Application(problems)	Either-or Type Both parts of each question from the same unit
	Question11(a)or11(b) To Question15(a)or15(b)
	Part-C (3x 10 = 30 Marks)Answer any THREE questionsEachquestioncarries10Marks
Analysis/Synthesis/Evaluation	There shall be FIVE questions covering all the five units
	Question 16 to Question 20

Each question should carry the course out come and cognitive level for instance,

SEMESTER I

Course	**Core(I)**
CourseCode	**CHEC101**
Title of the Course	**COORDINATIONANDNUCLEARCHEMISTRY**
Credits	**4**
Pre-requisites, if any	Studentsshouldknowaboutthefundamentalaspectsonstereochemistry,electrophilican d nucleophilic substitution reactions.
Course Objectives	• Realizethesignificance andrelevanceofstereochemistry • Roleofelectrophilicaswellasnucleophilicsubstitutionreactioninorganicsynthesis • Realizetheconcept ofselectivityin organictransformations • Understandthe conceptofreactionmechanism • Tovisualizetheconceptof substitutionVs reactivity
Course Outcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Learn aboutdifferentaspectsinvolvedinstereochemistryandtherelevance of thetopic in allbranches includingbiology(K1-K5)
CO2	Understandthebasicconceptandoriginofasymmetricsynthesis(K2-K4)
CO3	Learnaboutthesignificanceofreactionintermediatesandtherateofthereaction(K3-K5)
CO4	Selectivityand syntheticutilityof substitution reactions (K2-K6)
CO5	Understandthe relevance ofconformationandreactivityinorganicsynthesis(K5&K6)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	**Theories of coordination compounds** VB theory-CFT-Splitting of d orbital in ligand field and different symmetries-CFSE-Factors affecting the magnitude of 10 DQ-Evidence for crystal field stabilization (Structural and thermodynamic effects) - Spectrochemical series – Site selection in spinels - tetragonal distortion from octahedral symmetry-John Teller distortion - Nephelauxetic effect-Mo theory octahedral-tetrahedral and Square planar complexes-pi bonding and molecular orbital theory- experimental evidence for pi bonding.
II	**Stability and Stereochemical Aspects** Stability of complexes - thermodynamic aspects of complex formation, factors affecting stability, stability correlations, statistical and chelate effects; Determination of stability constants - polarographic, photometric and

	potentiometric methods.Stereochemical aspects - stereoisomerism in inorganic complexes,isomerism arising out of ligand distribution and ligand conformation,chirality.Macrocyclic ligand types - porphyrins, corrins, Schiff bases, crown ethers, cryptates and catenands. (simple complexes).
III	**Reaction Mechanism of transition metal complexes** Energy profile of a reaction-reactivity of metal complexes- inert and labile complexes-kinetic application of valence bond and crystal field theories. Kinetics of octahedral substitutions- acid hydrolysis- factors affecting acid hydrolysis- base hydrolysis- conjugate base mechanism- direct and indirect evidences in favour of conjugate mechanism- anation reactions- reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes- the trans effect- mechanism of the substitution reactions. Redox reactions- electron transfer reactions- mechanism of one electron transfer reactions- outer sphere type reactions- cross reactions and Marcus-Hush theory, inner sphere type reactions.
IV	**Nuclear Chemistry – I** The nucleus-subatomic particles and their properties-mass defect - binding energy - n/ p ratio in stable and metastable nuclei-Different types of nuclear forces-Liquid drop model and shell model.Modes of radioactive decay-Theory of alpha decay, beta decay and gamma radiation, Orbital electron capture, nuclear isomerism-internal conversion. Detection and determination of activity-GM, Scintillation and Cherenkov counters. Particle Accelerators: Linear accelerator- cyclotron, synchrotron, betatron and bevatron
V	**Nuclear Chemistry – II** Nuclear Reactions: Q-value, columbic barrier- nuclear cross section-different types of nuclear reactionsprojectile capture-particle emission, spallation, fission and fusion-product distributions - Theories of fission, use of fission products, fissile and fertile isotopes - U-238, U- 235, PU-239, Th232 -stellar energy-synthesis of new elements. Radio-Isotopes: Applications-isotopes as tracers - neutron activation analysis and isotopic dilution analysis - uses in structure and mechanistic studies - Carbon dating – Radio pharmacology, Radiation protection and safety precautions - Disposal of nuclear waste.

Recommended Text/Reference Books	• F. Basolo and R.G. Pearson, Mechanism of Inorganic Reactions, Wiley Eastern,1967. • J.E.Huheey, E.A.Keiter and R.L.Keiter, Inorganic chemistry-Principles of structure and reactivity, 4th edition, Pearson-Education,2002 • S.F.A. Kettle, Coordination compounds, ELBS,1973. • Cotton and Wilkinson : Advanced inorganic Chemistry, Wiley Eastern (P), Ltd.,1968 • H.J.Emeleus and A.G.Sharp : Modern aspects of Inorganic Chemistry, IV Edn.,1989. • Gurdeep Raj, Advanced Inorganic Chemistry-II Goel PublishingHouse,1996-97. • M.N.Hughes,The Inorganic Chemistry and Biological Processes,Wiley London,IIEdition.198 • A.K. Srivatsava and P.C. Jain, Elements of Nuclear Chemistry, S.Chand and Co.,1989

METHOD OF EVALUATION:

Continuous Internal Assessment	External Examination	Total
25	**75**	**100**

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview

Application(K3)–

Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain

Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge

Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create (K6) –** Check knowledge in specific or offbeat situations, Discussion, Debating orPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	M	S	S	M	M	M	L	M
CO2	M	M	M	S	S	M	M	M	L	L
CO3	L	L	M	S	S	M	S	L	L	M
CO4	L	M	L	S	M	M	L	M	L	L
CO5	L	L	M	S	M	M	M	L	L	L

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Course	**Core(II)**
CourseCode	**CHEC102**
Title of theCourse	**STEREOCHEMISTRY AND ORGANIC REACTION MECHANISM**
Credits	**4**
Pre-requisites, ifany	Studentsshouldknowaboutthefundamentalaspectsonstereochemistry,electrophilicand nucleophilic substitution reactions.
Course Objectives	• Realizethesignificance andrelevanceofstereochemistry • Roleofelectrophilicaswellasnucleophilicsubstitutionreactioninorganicsynthesis • Realizetheconcept ofselectivityin organictransformations • Understandthe conceptofreactionmechanism • Tovisualizetheconceptof substitutionVs reactivity
Course Outcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Learn aboutdifferentaspectsinvolvedinstereochemistryandtherelevance of thetopic in allbranches includingbiology(K1-K5)
CO2	Understandthebasicconceptandoriginofasymmetricsynthesis(K2-K4)
CO3	Learnaboutthesignificanceofreactionintermediatesandtherateofthereaction(K3-K5)
CO4	Selectivityand syntheticutilityof substitution reactions (K2-K6)
CO5	Understandthe relevance ofconformationandreactivityinorganicsynthesis(K5&K6)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	**STEREOCHEMISTRY-I** Chirality,Symmetryelements,AsymmetricandDissymmetricchiralmolecules. Calculation of number of optical isomers. Stereochemistry ofmonoanddi-substitutedcyclopropane,cyclobutane,cyclopentaneandcyclohexane. Stereochemistry of tri-substituted cyclopentane, tri-substitutedpentaneandtetra-substitutedhexane.Descriptionofvarioustypesofopticallyactivecompoundsincluding allenes,cumulenes,spiranes,biphenyls,*trans*-cyclooctene,Ansacompoundscyclophanesandhelicenes.
II	**STEREOCHEMISTRY-II** Compoundscontainingtwoasymmetriccenters-Erythroandthreoisomers. Conversion of Fischer projection into perspective forms. ErythroandThreo-InterconversionofFischertoSawhorseandNewmanprojections.Zig-Zagrepresentationofglucose.Interpretationofhomotopic,enantiotopicanddiastereot

	opicatomsandfaces.Originof*Re*-and*Si*-faces.Prochiral chiral carbon. R & S nomenclature of simple compounds, allenes, spiranes,biphenyls, Ansa compounds and cyclophane systems. Optical rotation andenantiomericexcess(ee).StereospecificandStereoselectivereactions.Asymmetric Synthesis-Crams rule and FelkinAnh Model. Conformationalanalysisof cyclohexaneanddi-substituted cyclohexanes.
III	**EFFECT OF STRUCTURE ON REACTIVITY** Resonance and field effects, resonance and steric effects, quantitative treatment- the Hammett equation- linear free energy relationship, substituent constant and reaction constant and limitations of Hammett equation, Taft equation, thermodynamically and kinetically controlled reactions, Hammond's postulate, Non- kinetic methods of determining mechanism- isolation, trapping and detection of intermediates, isotopic labeling, crossover experiments, product analysis, stereo chemical evidence, kinetic method -kinetic isotope effect
IV	**REACTION INTERMEDIATES AND ALIPHATIC ELECTROPHILIC SUBSTITUTION** Reaction intermediates - Formation, stability and structure of carbonium ions, carbanions, carbenes, nitrenes and free radicals Aliphatic electrophilic substitution- SE1, SE2 and SEi mechanisms and electrophilic substitution by double bond shift, hydrogen electrophile-keto-enoltautamerism, halogen electrophile-halogenation of aldehydes and ketones, nitrogen electrophile- aliphatic diazonium coupling, sulphur electrophile-sulphonation and carbon electrophile- Stork-enamine reaction.
V	**ALIPHATICNUCLEOPHILICSUSBTITUTION** Mechanismofnucleophlicsubstitutionreaction:SN^1,SN^2andSN^imechanisms.Solventandleavinggroupeffectsandneighboringgroupparticipation(NGP).Substitutionatcarbonyl,vinylicandbridgeheadsystem.Substitution with ambident nucleophiles: "O" Vs "C" alkylation. Role of LDA, crown ethers and phase transfer catalysts (PTC)in nucleophilic substitution reactions. Generationofenolates, enolateselectivity (KineticVsThermodynamic),alkylationofenolatesandstereochemistryofenolatealkylation. Mechanism of ester hydrolysis (only BAC^2, AAC^2 and AAL^1).Alkylationofactivemethylenecompounds.Asymmetricalkylation(Evans,EndersandMeyersprocedures).Preparationandsyntheticutilityofenamines,

Reading List(Print andOnline)	• OrganicChemistryPortal: https://www.organicchemistry.org/reactions.htm • OrganicSynthesisPortal:http:// www.orgsyn.org/ • Organic Chemistry notes:https://chemistrynotes.com/pages/organic-chemistry-notes • https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod8.pdf • YouTubehttp://Leah4sci.com/chirality; • YouTube:https://www.youtube.com/watch?v=yZ8JDDnyxC4
Recommended Text/Reference Books	• Carey, F. A &Giuliano, R. M. (2012); Organic Chemistry 8th Edition,McGraw Hill (I) PvtLtd • Bruice,P.Y.(2014);OrganicChemistry,7thEdition,DorlingKindersley (I) PvtLtd • Wade, Jr, L. G. & Singh, M. S. (2008); Organic Chemistry 6th Edition,DorlingKindersley(I) PvtLtd • Finar, I. L. Vol 2 (2018); Organic Chemistry: Stereochemistry and theChemistryof Natural product,IIIrdEdition,Pearson • Smith, M. B & March, J. (2006); March's Advanced Organic Chemistry:Reactions, Mechanisms, and Structure, 6th Edition, John Wiley & Sons,Inc. • Kalsi,P.S&Oza,R.S.(2018);OrganicReactions:StereochemistryandMechanism, NewAgeInternational • Clayden,J,Greeves,N.Warren,S.(2017);OrganicChemistry,2ndEdition,Oxford UniversityPress. • Graham Solomons, T. W, Fryhle, C. B. (2014); Organic Chemistry, 10thEdition,Wiley.

METHOD OF EVALUATION:

Continuous Internal Assessment	External Examination	Total
25	**75**	**100**

Methodsofassessment:
Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview
Application(K3)–
Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain
Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge
Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create (K6) –** Check knowledge in specific or offbeat situations, Discussion, Debating orPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	M	S	S	M	M	M	L	M
CO2	M	M	M	S	S	M	M	M	L	L
CO3	L	L	M	S	S	M	S	L	L	M
CO4	L	M	L	S	M	M	L	M	L	L
CO5	L	L	M	S	M	M	M	L	L	L

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

Course	**Core(II)**
CourseCode	**CHEC103**
Title of theCourse	**ORGANIC CHEMISTRY PRACTICAL-I**
Credits	**4**
Pre-requisites, ifany	Studentsshouldknowthebasictechniquesusedintheorganiclaboratoryforpreparation, purificationandidentification oforganic compounds.
Course Objectives	• Tounderstandthebasictechniquesusedinorganiclaboratoryforpreparationand purification oforganiccompounds • Tocomparetheorywithexperimentbyperformingpreparationoforganiccompounds • Tounderstandthereactionmechanismandintermediatesinvolvedinorganicreaction. • Abletovisualizetheorganictransformationsinthereactionflask.
Course Outcomes	On the successful completion of the course, students will acquireknowledgeof:
CO1	Goodlaboratorypractices inhandlinglaboratoryglasswaresandchemicals (K1-K6)
CO2	Togainexperienceinthe maintenancelaboratorynotebook(K2-K4)
CO3	Wellversedwithcommonlaboratorytechniquessuchasreflux,recrystallization, vacuum filtration, aqueous extraction and melting pointdetermination(K2-K5)
CO4	Tounderstandthedifficulties involvedinthepreparationoforganic compounds(K1-K5)
CO5	Understandthedifferences intheoryandpracticalconcept(K4-K6)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	**SingleStagePreparations** 1. Preparationof*p*-benzoquinone 2. Preparationof2,5-ditertiarybutylhydroquinone 3. Preparationof4,6-dimethylcoumarin 4. Preparationofdibenzyllideneacetone 5. Preparationof2,4-dinitrotoluene 6. Preparationofbenzhydrol
II	**Separation and analysis:** A. Two component mixtures. B. Three component mixtures.
Reading List(Print andOnline)	• https://www.youtube.com/watch?v=1oO-fQvMrkE • https://www.youtube.com/watch?v=oROSQnzSdZE

Recommended Text/Reference Books	• Vogel,A.I.;Tatchell,A.R.;Furnis,B.S.;Hannaford,A.J.; Smith, P.W.G.(2003);Vogel'sTextbookofPracticalOrganicChemistry,5th Edition,Pearson Education

Methodof Evaluation:

Internal(ContinuousAssessment)	End SemesterExamination	Total	Grade
60	40	100	A,A+,B,D,D+,O

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview

Application(K3)–

Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain

Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge

Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	M	M	M	M	M	M	M	S
CO2	M	L	M	M	M	M	M	M	L	L
CO3	M	M	M	L	S	M	L	L	M	M
CO4	L	M	L	M	M	L	M	M	L	L
CO5	M	M	M	M	M	L	M	L	L	L

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">PHARMACEUTICAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Elective I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">CHEE101</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basic knowledge on drugs and doses</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">To understand the advanced concepts of pharmaceutical chemistry.
To recall the principle and biological functions of various drugs.
To train the students to know the importance as well the consequences of various drugs.
To have knowledge on the various analysis and techniques.
To familiarize on the drug dosage and its structural activities.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT-I: Physical properties in Pharmaceuticals:Physical properties of drug molecule: physical properties. Refractive index- Definition, explanation, formula, importance, determination, specific & molar refraction. Optical activity\rotation- monochromatic & polychromatic light, optical activity, angle of rotation, specific rotation examples, measurement of optical activity. Dielectric constant & Induced Polarization- Dielectric constant explanation &determination.Rheology of pharmaceutical systems: Introduction, Definition, Applications, concept of viscosity, Newton’s law offlow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity. Newtonian system, non-Newtonian system- Plastic flow, Pseudoplastic flow, Dilatent flow. Viscosity measurements- selection of viscometer for Newtonian and non-Newtonian system.</td></tr>
<tr><td colspan="8">UNIT-II:Isotopic Dilution analysis: principle and applications, Neutron activation analysis: Principle, advantages and limitations, Scintillation counters. Body scanning. Introduction to radiopharmaceuticals. Properties of various types of radiopharmaceuticals, Radiopharmaceuticals as diagnostics, as therapeutics, for research and sterilization,Physico Chemical Properties and drug action. Physico chemical properties of drugs (a) Partition coefficient, (b) solubility (c) surface activity, (d) degree of ionization.</td></tr>
<tr><td colspan="8">UNIT-III: Drug dosage and product development:Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a</td></tr>
</table>

	dosage form, classification of dosage forms. Drug dosage and product development. Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms.
	UNIT-IV: Development of new drugs: Introduction, procedure followed in drug design, the research for lead compounds, molecular modification of lead compounds. Structure-Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect,isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups,theories of drug activity, occupancy theory, rate theory, induced-fit theory,4.3Quantitative structure activity relationship(QSAR): Development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionizationconstants, steric parameters, chelation parameters, redox potential, indicator-variables.
	UNIT-V:Computers in Pharmaceutical Chemistry: Need of computers for chemistry. Computers for Analytical Chemists-Introduction to computers: Organization of computers, CPU, Computer memory, I/O devices, information storage, software components. Application of computers in chemistry: Programming in high level language (C+) to handle various numerical methods in chemistry – least square fit, solution to simultaneous equations, interpolation, extrapolation, data smoothing, and numerical differentiation and integrations.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Physical Chemistry- Bahl and Tuli. 2. Text Book of Physical Pharmaceutics, IInd edition, VallabhPrakashan-.C.V.S. Subramanyam. 3. Medicinal Chemistry (Organic Pharmaceutical Chemistry), G.R Chatwal, Himalaya Publishing house. 4. Instrumental method of Analysis: Hubert H, Willard,7th edition. 5. Textbook of Pharmaceutical Chemistry by,JayshreeGhosh, S. Chand & company Ltd.Pharmaceutical Chemistry by Dr. S. Lakshmi, Sultanchand& Sons.
Reference Books	1. Computers in chemistry, K.V. Raman, Tata Mc.Graw-Hill, 1993.

	2. Computers for Chemists, S.K Pundir, Anshubansal, A pragateprakashan., 2 nd edition, New age international (P) limited, New Delhi. 3. Physical Pharmacy and Pharmaceutical Sciences by Martins, Patrick J. Sinko, Lippincott. William and Wilkins. 4. Cooper and Gunn's Tutorial Pharmacy ,6th edition by S.J. Carter, CBS Publisher Ltd. 5. Ansels pharmaceutical Dosage forms and Drug Delivery System by Allen Popvich and Ansel, Indian edition-B.I. Publication Pvt. Ltd.
Website and e-learning source	https://www.ncbi.nlm.nih.gov/books/NBK482447/ https://training.seer.cancer.gov/treatment/chemotherapy/types.html
Course Learning Outcomes (for Mapping with POs and PSOs) Students will be able: CO1: To identify the suitable drugs for various diseases. CO2: To apply the principles of various drug action and drug design. CO3: To acquire the knowledge on product development based on SAR. CO4: To apply the knowledge on applications of computers in chemistry. CO5:To synthesize new drugs after understanding the concepts SAR.	

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Course	**Elective(II)**
CourseCode	**CHEE102**
Title of theCourse	**NAME REACTIONS IN ORGANIC CHEMISTRY**
Credits	**3**
Pre-requisites, ifany	Studentsmusthaveknown aboutthebasicorganic namereactions.
Course Objectives	• Tounderstand newcarbon-carbonformationbynamereactions • Tounderstandtheheterocyclesynthesisthroughnamereactions • Tostudythesignificances ofnamereactionin organicsynthesis • Importanceofsubstitutionreactionandtheir syntheticutilities
Course Outcomes	On the successful completion of the course, students will acquireknowledgeof:
CO1	Designandsynthesesoforganicmoleculesbasedonnamereaction(K2-K5)
CO2	Understandthemechanisminvolvedinorganic namereactions(K1-K4)
CO3	Understandkeyintermediates involvedinorganicnamereactions (K1- K4)
CO4	Understandfunctionalgrouptransformationsandreactivityinorganicname reactions(K2-K4)
CO5	Exploresyntheticutilityofname reactionsin organicsynthesis (K3-K5)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	Carbon-Carbonbondformationreactions-Perkin,Knovenagel,Wittig,Wittig-Horner,VilsmeierHaack,McMurray,Glacer,Mannich,Pschorr,Simmons-Smithand Thorpereactions. Michael addition, 1,3-dipolar addition, carbine and their addition and Diel's-Alder reaction
II	Heterocycle forming reactions-Paal-Knorr synthesis of pyrroles; Hantschsynthesis of pyridines, Madelung, Reissert and Bischler synthesis of indole**;**Skraup, Friedländer ,Doebner-Miller and Konard-Limpatch synthesis ofquinoline.Pomerantz-Fritsch synthesis of isoquinoline.
III	Namereactionsonsubstitutionandsubstituents-Chichibabinreaction,EschweilerClarkreaction,Polonowskireaction,Reissert reaction,Sommlettreactions,Mitsunobureaction,Leukartreaction,Buchererreaction,Willegerodtreaction andWillegerodt-Kindler reaction.
IV	Catalytic hydrogenation, Homogenous and heterogenous catalytic reductions, Dissolving metal reductions including Birch reduction, Bouveault-Blanc reduction, clemmensen and Wolff Kishner reductions,

	MPV reduction.Metal hydride reductions- NaBH4, LiAlH4, LTBA, BH3, Bu3SnH and Sodium cyanoborohydride.
V	Dieckmann cyclization, Shapiro, Stork enamine, Sharpless asymmetric epoxidation, Robinson annulation, Duff, Simmons-Smith, Hoffman - Loffler- Freytag, BamfordStevens, Henry, Ugi, Wadsworth-Emmons, Barton and ene reactions.
Reading List(Print andOnline)	• https://nptel.ac.in/courses/104/103/104103110/ • https://nptel.ac.in/courses/104/105/104105034/ • https://nptel.ac.in/courses/104/101/104101115/
Recommended Text/Reference Books	• March,J.(2007);AdvancedOrganicChemistry,6th Edition,Wiley • Carey, F. Sundberg R. J. Advanced Organic Chemistry-Part A and B-5thEdition,Springer • Clayden,J,Greeves,N,Warren,S.(2012);OrganicChemistry,2nd Edition,Oxford

Methodof Evaluation:

SessionalI	SessionalII	EndSemesterExamination	Total	Grade
20	20	60	100	A,A+,B,D,D+,O

Methodsofassessment:
Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview
Application (K3) – Suggest idea/concept with examples, Suggest formulae, Solve problems,Observe,Explain
Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge
Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	M	S	M	M	M	M	L	L
CO2	L	L	M	S	M	M	M	M	M	L
CO3	M	M	M	S	M	M	S	L	L	M
CO4	L	M	L	M	M	L	M	M	L	L
CO5	M	M	M	M	M	L	M	L	L	L

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

SEMESTER **II**

Course	**Core(III)**
CourseCode	**CHEC204**
Title of theCourse	**ORGANIC REACTION MECHANISM**
Credits	**4**
Pre-requisites, ifany	Studentsshouldknowaboutthefundamentsofconceptofchemicalreactionandtheir mechanism.
Course Objectives	• Tostudythebasic concepts additionandeliminationreactionsand theirmechanism. • To predict the selectivity and stereo-chemical outcome of additionreactions,eliminationreactions,oxidationandreductionreactions • Tounderstandthebasicconceptsofgrouporatommigrationduringmolecularrearrangements alongwith mechanisticdetails • Realizeimportanceofoxidationandreductionreagentsinorganicsynthesis
Course Outcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Understand different aspects of addition reactions and elimination reactions(K2-K5)
CO2	Familiarwithvarioustypesofmolecularrearrangementsandtheir mechanisms(K1-K6)
CO3	Understandtheconceptofatom or groupmigration involvedinmolecular rearrangements (K2,K3,K4andK5)
CO4	Understandthesignificanceandmechanismofvarioustypesoxidationand reductionreactions(K2,K4andK5)
CO5	Understandthe selectivityand syntheticutilityofaddition, elimination, oxidationandreductionreactions(K1-K5)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	**ADDITIONANDELIMINATIONREACTIONS** Electrophilicadditiontocarbon–carbondoubleandtriplebonds.Nucleophilicadditiontocarbon–carbonmultiplebonds.Generationandadditionof carbenes-Michael additionand Robinson annulation. Nucleophilic addition to –C=O bond- A study of Mannich, benzoin,Darzen'sglycidicester,StobbeandKnovenegalcondensationreactions-Wittig,Wittig-Hornerolefinationreaction-Julia&Petersonalkenesynthesis. Eliminationreactions:E_1,E_2,E_{1cb}andE_i-elimination.Conformationofmechanism;solvent,substrate,leaving group effects-Saytzeff's*Vs*Hoffmanelimination;ChugaevandCopeelimination.

II	**MOLECULARREARRANGEMENTSANDNAMEREACTIONS** A study of mechanismof the following rearrangements:Beckmann,Curtius, Hoffmann, Schmidt,Lossen, Wolff, Pinacol, WagnerMeerwin,Demyanov, Dienone-Phenol, Favorski, Benzidine, Claisen, Cope, Sommlet-Hauser,Pummerer and Von-Richter rearrangements. Astudyofthefollowingnamereactions:Dieckmanncyclization,Hoffmann-LofflerFreytagreaction,Shapiroreaction,Eschenmoser-TanabeandRamburg-Backlundreactions.
III	**OXIDATIONANDREDUCTIONREACTIONS** Oxidation with Cr and Mn reagents; Oxidation with LTA, DDQ andSeO_2; Oxidation using DMSO either with DCC or Ac_2O or Oxalyl chloride;OxidationusingDessMartinreagent.Hydroxylationofolefinicdoublebonds(OsO_4,$KMnO_4$);WoodwardandPrevostoxidation.Epoxidationusingperacidsincluding Sharplessepoxidation, Ozonolysis. Reduction with $NaBH_4$, $LiAlH_4$, $Li(^tBuO)_3AlH$, DIBAL-H, Red-Al, Et_3SiH and Bu_3SnH; Reduction usingselectrides,Birch reduction. Hydrogenation(homogenousandheterogeneous),hydrationofcarbon-carbondoubleand triplebonds. Asymmetricreductionofcarbonylfunctions(Corey'sprocedure).
IV	**AROMATICELECTROPHILIC&NUCLEOPHILICSUSBTITUTIONREACTIONS** Aromaticelectrophilicsubstitution:mechanismofnitration,sulfonation,Friedel-Crafts alkylation and acylation reactions. Synthesis of di- and tri-substituted benzenes from benzene or mono-substituted benzenes. Haworthreaction (for naphthalene), Scholl reaction, Vilsmeier-Haackformylation,Gattermannreaction,Reimer-TiemannandBischler-Napieralskireactions. Aromatic nucleophilic substitution in aryl halides by Meisenheimercomplex mechanism and benzyne mechanism. Various methods of benzynegenerationandreactionsofbenzynes(interandintramolecular).Reactionsofaryldiazonium salts. Zeigler alkylation, Vicarious Nucleophilic Substitution(VNS),Chichibabin andSchiemann reactions.

V	**REAGENT IN ORGANIC CHEMISTRY** Reagents and their uses – LDA, DCC, DDQ, DBU, DIBAL, 9-BBN, NBS, 1,3-dithiane (umpolug), trimethylsilylchloride, trimetylsilyliodide, Baker's yeast, Gilman's reagent and Wilkinson'scatalyst
Reading List(Print andOnline)	• Organic Chemistry Portal:https://www.organic-chemistry.org/ • OrganicSynthesisPortal:http://w ww.orgsyn.org/ • Organic Chemistry notes:https://nptel.ac.in/courses/104/101/104101005/ht tps://nptel.ac.in/courses/104/101/104101127/ • YouTube:https://onlinecourses.swayam2.ac.in/ugc19_ch01/preview • YouTube:https://onlinecourses.swayam2.ac.in/cec21_cy02/preview
Recommended Text/Reference Books	• Norman,R.O.C&Coxon,J.M(1993);PrinciplesofOrganicSynthesis,3rdEdition,*CR C Press*. • Ahluwalia,V.K.(2012);OxidationinOrganicSynthesis,AneBooksPvt.Ltd. • Smith,M.B.(2015);March'sAdvancedOrganicChemistry:Reactions,Mechanisms, and Structure,7thEdition,JohnWiley& Sons,Inc. • Carruthers,W.&Coldham,I.(2015);Modern MethodsofOrganicSynthesis,4thEdition,CambridgeUniversitypress, UK. • StuartWarren,(2007);OrganicSynthesis:TheDisconnectionApproach,2nd Edition, Wiley. • March,J (2006);AdvancedOrganicChemistry, 4th Edition,Wiley. • Carey,F.A.&Sundberg,R.J.(2008);AdvancedOrganicChemistry-PartAand B. 5thEdition, Springer.
	• Clayden,J,Greeves,N,Warren,S&Wothers,P(2000);OrganicChemistry,Oxford UniversityPress. • House,H.O.(1998);ModernOrganicSynthesis,2ndEdition.W.A.Benjamin,New York.

Methodof Evaluation:

SessionalI	SessionalII	EndSemester Examination	Total	Grade
20	20	60	100	A,A+,B,D,D+,O

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview

Application(K3)–

Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain

Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge

Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create (K6) –** Check knowledge in specific or offbeat situations, Discussion, Debating orPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	S	L	S	S	M	L	M	L
CO2	M	M	M	L	S	S	M	M	L	L
CO3	M	M	M	M	S	M	M	L	L	L
CO4	M	M	M	M	S	S	M	M	L	L
CO5	M	M	S	M	S	M	L	M	L	L

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

Course	**Core(V)**
CourseCode	**CHEC205**
Title of theCourse	**QUANTUM CHEMISTRYAND GROUP THEORY**
Credits	**4**
Pre-requisites,if any	Studentsshouldknowaboutthefundamentsofconceptofchemicalreactionandtheirmechanism.
CourseObjectives	• Tostudythebasic concepts additionandeliminationreactionsand theirmechanism. • To predict the selectivity and stereo-chemical outcome of additionreactions,eliminationreactions,oxidationandreductionreactions • Tounderstandthebasicconceptsofgrouporatommigrationduringmolecularrearrangements alongwith mechanisticdetails • Realizeimportanceofoxidationandreductionreagentsinorganicsynthesis
CourseOutcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Understand different aspects of addition reactions and elimination reactions(K2-K5)
CO2	Familiarwithvarioustypesofmolecularrearrangementsandtheir mechanisms(K1-K6)
CO3	Understandtheconceptofatom or groupmigration involvedinmolecular rearrangements (K2,K3,K4andK5)
CO4	Understandthesignificanceandmechanismofvarioustypesoxidationand reductionreactions(K2,K4andK5)
CO5	Understandthe selectivityand syntheticutilityofaddition, elimination, oxidationandreductionreactions(K1-K5)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	**Quantum Chemistry – I (15 Hours)** Planck's theory of black body radiation – Photoelectric effect; de – Broglie equation – Heisenberg uncertainty principle – Compton effect; operators and commutation relations – quantum mechanical postulates – Schrodinger equation and its solution to the problem of a particle in one and three dimensional boxes – the harmonic oscillator.

II	**Quantum Chemistry –II (15 Hours)** Application of Schrödinger equation to rigid rotator and hydrogen atom – origin of quantum numbers – probability distribution of electrons. Approximation methods – Perturbation and Variation methods – Slater determinant -application to hydrogen and helium atom — Spin - orbit interaction – LS coupling and JJ coupling – ground state term symbols for simple atoms.
III	**Quantum Chemistry III** Theory of chemical bonding – Born – Oppenheimer approximation – LCAO – MO approximation for hydrogen molecule ion and hydrogen molecule – Valence Bond theory of hydrogen molecule – Concept of hybridisation – sp, sp2 and sp3hybridisation – Huckel Molecular orbital (HMO) theory for conjugated π- systems application to ethylene, butadiene and benzene – Self consistent field approximation –Hartree and Hartree – Fock self consistant field theory .
IV	**Group Theory – I (15 Hours)** Symmetry elements and symmetry operations – Point groups – identification and representation of groups – comparison of molecular and crystallographic symmetry – Reducible and irreducible representation – Direct product representation – Great orthogonality theorem and its consequences – Character table and its uses.
V	**Group Theory – II (15 Hours)** Symmetry selection rules for vibrational, Electronic and Raman Spectra – determination of vibrational modes in non-linear molecules such as H_2O, NH_3, CH_4 and XeF_4, – symmetry of hybrid orbitals in non-linear molecules (H_2O, NH_3, CH_4, XeF_4 and PCl_5) 2 Electronic spectra of formaldehyde.
Reading List(Print andOnline)	• Organic Chemistry Portal:https://www.organic-chemistry.org/ • OrganicSynthesisPortal: http://www.orgsyn.org/ • Organic Chemistry notes:https://nptel.ac.in/courses/104/101/104101005/https://nptel.ac.in/courses/104/101/104101127/ • YouTube:https://onlinecourses.swayam2.ac.in/ugc19_ch01/preview • YouTube:https://onlinecourses.swayam2.ac.in/cec21_cy02/preview

RecommendedText/Reference Books	• Norman,R.O.C&Coxon,J.M(1993);PrinciplesofOrganicSynthesis,3rdEdition,*CRC Press*. • Ahluwalia,V.K.(2012);OxidationinOrganicSynthesis,AneBooksPvt.Ltd. • Smith,M.B.(2015);March'sAdvancedOrganicChemistry:Reactions,Mechanisms,and Structure,7thEdition,JohnWiley& Sons,Inc. • Carruthers,W.&Coldham,I.(2015);Modern MethodsofOrganicSynthesis,4thEdition,CambridgeUniversitypress, UK. • StuartWarren,(2007);OrganicSynthesis:TheDisconnectionApproach,2nd Edition, Wiley. • March,J (2006);AdvancedOrganicChemistry, 4th Edition,Wiley. • Carey,F.A.&Sundberg,R.J.(2008);AdvancedOrganicChemistry-PartAand B. 5thEdition, Springer.
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Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create (K6) –** Check knowledge in specific or offbeat situations, Discussion, Debating orPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	S	L	S	S	M	L	M	L
CO2	M	M	M	L	S	S	M	M	L	L
CO3	M	M	M	M	S	M	M	L	L	L
CO4	M	M	M	M	S	S	M	M	L	L
CO5	M	M	S	M	S	M	L	M	L	L

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">INORGANIC CHEMISTRY PRACTICAL</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>-</td><td>1</td><td colspan="3">4</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basic principles of gravimetric and qualitative analysis</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">To understand and enhance the visual observation as an analytical tool for the quantitative estimation of ions.
To recall the principle and theory in preparing standard solutions.
To train the students for improving their skill in estimating the amount of ion accurately present in the solution
To estimate metal ions, present in the given solution accurately without using instruments.
To determinethe amount of ions, present in a binary mixture accurately.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT-I: Analysis of mixture of cations:Analysis of a mixture of four cations containing two common cations and two rare cations.Cations to be tested.
Group-I : W, Tl and Pb.
Group-II : Se, Te, Mo, Cu, Bi and Cd.
Group-III : Tl, Ce, Th, Zr, V, Cr, Fe, Ti and U.
Group-IV : Zn, Ni, Co and Mn.
Group-V : Ca, Ba and Sr.
Group-VI : Li and Mg.</td></tr>
<tr><td colspan="8">UNIT-II:Preparation of metal complexes: Preparation of inorganic complexes:
a. Preparation of tristhioureacopper(I)sulphate
b. Preparation of potassium trioxalate chromate(III)
c. Preparation of tetramminecopper(II) sulphate
d. Preparation of Reineck’s salt
e. Preparation of hexathioureacopper(I) chloridedihydrate
f. Preparation of cis-Potassium tri oxalate diaquachromate(III)
g. Preparation of sodium trioxalatoferrate(III)
h. Preparation of hexathiourealead(II) nitrate</td></tr>
<tr><td colspan="8">UNIT-III: Complexometric Titration:
1. Estimation of zinc, nickel, magnesium, and calcium.
2. Estimation of mixture of metal ions-pH control, masking and damasking agents.
3. Determination of calcium and lead in a mixture (pH control).
4. Determination of manganese in the presence of iron.
5. Determination of nickel in the presence of iron.</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="8">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
</table>

Recommended Text	1. A. JeyaRajendran, Microanalytical Techniques in Chemistry: Inorganic Qualitative Analysis, United global publishers, 2021. 2. V. V. Ramanujam, *Inorganic Semimicro Qualitative Analysis*; 3rded.,The National Publishing Company, Chennai, 1974. 3. *Vogel's Text book of Inorganic Qualitative Analysis,* 4thed., ELBS, London.
Reference Books	1. G. Pass, and H. Sutcliffe, *Practical Inorganic Chemistry*; Chapman Hall, 1965. 2. W. G. Palmer, Experimental *Inorganic Chemistry*; Cambridge University Press, 1954.
Course Learning Outcomes (for Mapping with POs and PSOs) Students will be able: CO1: To identify the anions and cations present in a mixture of salts. CO2: To apply the principles of semi micro qualitative analysis to categorize acid radicals and basic radicals. CO3: To acquire the qualitative analytical skills by selecting suitable confirmatory tests andspot tests. CO4: To choose the appropriate chemical reagents for the detection of anions and cations. CO5:To synthesize coordination compounds in good quality.	

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="7">MATERIAL SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td>Course Code</td><td>CHEE203</td></tr>
<tr><td>Semester</td><td>II</td><td>Course Code</td><td>CHEE203</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of solid-state chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">To understand the crystal structure, growth methods and X-ray scattering.
To explain the optical, dielectric and diffusion properties of crystals.
To recognize the basis of semiconductors, superconductivity materials and magnets.
To study the synthesis, classification and applications of nanomaterials.
To learn about the importance of materials used for renewable energy conversion.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I:Crystallography:
Symmetry - unit cell and Miller indices -crystal systems - Bravais lattices - point groups and space groups - X-ray diffraction-Laue equations-Bragg's law-reciprocal lattice and its application to geometrical crystallography. Crystal structure–powder and single crystalapplications. Electron charge density maps, neutron diffraction-method and applications.</td></tr>
<tr><td colspan="7">UNIT-II:Crystal growth methods:
Nucleation–equilibrium stability and metastable state. Single crystal –Low and high temperature, solution growth– Gel and sol-gel. Crystal growthmethods-nucleation–equilibrium stabilityandmetastablestate.Singlecrystal–Lowandhightemperature, solution growth– Gel and sol-gel. Melt growth Bridgeman-Stockbarger,Czochralskimethods.Fluxtechnique,physicalandchemical vapourtransport.Lorentz and polarization factor - primary and secondary extinctions.</td></tr>
<tr><td colspan="7">UNIT-III:Properties of crystals:
Optical studies - Electromagnetic spectrum (qualitative) refractive index – reflectance – transparency, translucency and opacity. Types of luminescence – photo-, electro-, and injection luminescence, LEDs – organic, Inorganic and polymer LED materials - Applications. Dielectric studies- Polarisation - electronic, ionic, orientation, and space charge polarisation. Effect of temperature. dielectric constant, dielectric loss. Types of dielectric breakdown–intrinsic, thermal, discharge, electrochemical and defect breakdown.</td></tr>
</table>

	UNIT-IV:Special Materials: Superconductivity: Meissner effect, Critical temperature and critical magnetic Field, Type I and II superconductors, BCS theory-Cooper pair, Applications.Soft and hard magnets – Domain theory Hysteresis Loop-Applications. Magneto andgian magneto resistance. Ferro, ferri and antiferromagnetic materials-applications, magnetic parameters for recording applications. Ferro-, Piezo-, and pyro electric materials – properties and applications. Shape memory Alloys-characteristics and applications, Non-linear optics-Second Harmonic Generators, mixing of Laser wavelengths by quartz, ruby and $LiNbO_3$.
	UNIT-V:Materials for Renewable Energy Conversion: Solar Cells: Organic, bilayer, bulk heterojunction, polymer, perovskite based. Solar energy conversion: lamellar solids and thin films, dye-sensitized photo voltaic cells, coordination compounds anchored onto semiconductor surfaces - Ru(II) and Os(II) polypyridyl complexes. Photochemical activation and splitting of water, CO2 and N2. Manganese based photo systems for water-splitting. Complexes of Rh, Ru, Pd and Pt - photochemical generation of hydrogen from alcohol.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. S. Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016. 2. Arumugam, Materials Science, Anuradha Publications, 2007. 3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010 4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012. 5. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6th ed., PEARSON Press, 2007.
Reference Books	1.Suggested Readings 1. M.G. Arora, Solid State Chemistry, Anmol Publications, New Delhi, 2001. 2. R.K. Puri and V.K. Babbar, Solid State Physics, S Chand and Company Ltd, 2001. 3.. C. Kittel, Solid State Physics, John-Wiley and sons, NY, 1966.

	4. H.P. Meyers, Introductory Solid State Physics, Viva Books Private Limited, 1998. 5. A.R. West, Solid State Chemistry and Applications, John-Wiley and sons, 1987.
Website and e-learning source	1. http://xrayweb.chem.ou.edu/notes/symmetry.html. 2. http://www.uptti.ac.in/classroom-content/data/unit%20cell.pdf. 3. https://bit.ly/3QyVg2R

Course Learning Outcomes (for Mapping with POs and PSOs)
Students will be able:
CO1: To understand and recall the synthesis and characteristics of crystal structures,semiconductors, magnets, nanomaterials and renewable energy materials.
CO2: To integrate and assess the structure of different materials and their properties.
CO3: To analyse and identify new materials for energy applications.
CO4: To explain the importance of crystal structures, piezoelectric and pyroelectricmaterials, nanomaterials, hard and soft magnets, superconductors, solar cells, electrodes, LEDuses, structures and synthesis.
CO5:To design and develop new materials with improved property for energy applications.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Course	**Elective(IV)**
CourseCode	**CHEE204**
Titleofthe Course	**FUNCTIONALGROUP TRANSFORMATION INORGANIC CHEMISTRY**
Credits:	**3**
Pre-requisites,ifany	Studentsshouldknowaboutvarioustypesoffunctionalgroupsaswellasorganicreactions
CourseObjectives	• To learn various types of functional group transformations involvingdifferenttypes ofoxidation reactions • Tolearnfunctionalgrouptransformationsinvolvingdifferenttypesofreducingagents • Tounderstanddifferenttypesoffunctional grouptransformationsinvolvingmiscellaneouscategoryofreagents/namereactions • Toidentifysuitable reagents forcarryingspecific synthetictransformations.
Course Outcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Understand different types of functional group transformations involvingoxidizingagents(K2-K5)
CO2	Familiarize with functional group transformations involving reducingagents (K2-K6)
CO3	Understandfunctionalgrouptransformationsinvolvingmiscellaneouscategoryof reagents/namereactions(K2-K5)
CO4	Identify suitable reagents to perform chemo-selective functional grouptransformations (K1-K6)
CO5	Evaluation of different types of synthetic transformations involvingoxidizing,reducingandmiscellaneouscategoryofreagents(K1-K6)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	**FUNCTIONALGROUPTRANSFORMATIONSUSINGOXIDIZINGREAGENTS** UseofChromiumreagents(CrO_3,$K_2Cr_2O_7$,CrO_2Cl_2,PCC,PDCandPFC).Use of Manganese reagents ($KMnO_4$, MnO_2, CTAP). Use of RuO_4, $KBrO_3$,DMSO,NCS, $NaIO_4$, peracids and boranes.
II	**FUNCTIONALGROUPTRANSFORMATIONSUSINGREDUCINGREAGENTS** Useof$NaBH_4$,$NaCNBH_3$,$LiAlH_4$andBu_3SnH;UseofSn/HCl,Zn/HCl,Hydrazine, Li-NH_3, Na/alcohol,

	Pd/H_2andRaneyNi.
III	**FUNCTIONALGROUPTRANSFORMATIONSUSINGMISCELLANEOUSTYPE OFREAGENTS** Use of $SOCl_2$, PBr_3, PPh_3-CCl_4, LiBr, NaI, NBS, PPh_3-X_2, Lawesson'sreagent,Mitsunobureagent,CH_2N_2,TMSCHN_2andBarbier-Weilanddegradation. Conversion of aldehyde to ketone and vice versa; Conversionof aldehyde to cyanide, Conversion of cyanide to ester, Conversion ofketone/aldehydeto phenol; conversion ofketone to enone.
IV	**Reagent in organic chemistry (15 Hours)** Reagents and their uses – LDA, DCC, DDQ, DBU, DIBAL, 9-BBN, NBS, 1,3- dithiane (umpolug), trimethylsilylchloride, trimetylsilyliodide, Baker's yeast, Gilman's reagent and Wilkinson'scatalyst
V	**FIVEMEMBERHETEROCYCLESWITHTWOHETEROATOMS** Imidazole, oxazole, thiazole and their benzo analogues-Synthesis,reactivity including lithiation and aromatic character. Comparative study oftheir reactivity. Isoxazole, isothiazole and pyrazole-Synthesis and reactivityincluding lithiation. Indole, benzo[*b*]thiophene and benzo[*b*]furan-Synthesisand reactivityincludinglithiation.
Reading List(Print andOnline)	• OrganicChemistryPortal:https://www.organicchemistry.org/reactions.htm • OrganicSynthesisPortal:http://www.orgsyn.org/ • OrganicChemistrynotes:https://chemistrynotes.com/pages/organic-chemistry-notes • https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod8.pdf • YouTubehttp://Leah4sci.com/chirality; • YouTube:https://www.youtube.com/watch?v=yZ8JDDnyxC4
Recommended Texts/Reference books	• JerryMarch.(2006);AdvancedOrganicChemistry,4th Edition,Wiley. • Carey,F.A.&Sundberg,R.J.(2008);AdvancedOrganicChemistry-PartAand B. 5thEdition, Springer. • Clayden,J,Greeves,N.Warren,S.(2017);OrganicChemistry,2ndEd,Oxford UniversityPress. • GrahamSolomons,T.W,Fryhle,C.B.(2014);OrganicChemistry,10thEdition ,Wiley. • Smith, M. B. (2015); March's Advanced Organic Chemistry: Reactions,Mechanisms,and Structure,7thEdition,JohnWiley& Sons,Inc.

Methodof Evaluation:

SessionalI	SessionalII	EndSemester Examination	Total	Grade
20	20	60	100	A,A+,B,D,D+,O

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview

Application(K3)–

Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain

Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge

Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	S	S	S	M	M	L	M	M
CO2	M	M	S	S	S	L	L	M	L	M
CO3	M	M	S	M	S	M	L	L	M	S
CO4	M	M	M	M	S	S	L	M	L	S
CO5	M	M	S	M	S	M	L	L	L	M

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15

Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Title of the Course	**SKILL ENHANCEMENT COURSE- I INDUSTRIAL CHEMISTRY**					
Paper No.	**SEC-I**					
Category	SEC	Year	I	Credits	2	Course Code
		Semester	II			
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total	
	2	1	-		3	
Prerequisites	Basic concepts of Industrial chemistry					
Objectives of the course	Knowledge of important chemical and reagents used in chemical industries. Understand the basic principle behind various mixtures used in chemical industries and their selection in respective applications. Understand the safety and Hazardous criteria related to unit process. Gain knowledge about fertilizer					
Course Outline	**UNIT-I: Principles Of Chemical Technology** Introduction – basic principles of chemical technology – importance of chemical technology – classification of technological process – designing and modeling of chemical plants – unit process and unit operations. Basic requirements of industrial reactors – choice and selectivity of reactor – basic principles of homogeneous and heterogeneous processes and reactors with examples.					
	UNIT-II:Raw Materials And Energy For Chemical Industry Raw materials – Characteristics of raw materials and their resources – methods of raw material concentration – integral utilization of raw materials. Energy for chemical industry – power and fuels – classification of fuels – coal – fuel gases and liquid fuels – petroleum – cracking – chemical corrosion – types of corrosion and preventive measures.					
	UNIT-III:Small Scale Chemical Industries Electro-thermal and electro- chemical industries: electroplating – surface coating industries – oils, fats and waxes – soaps and detergents – cosmetics. Match industries and Fire Works: Manufacture of some industrially important chemicals like potassium chlorate, potassium nitrate, barium nitrate and red phosphorous – metal powders.					
	UNIT-IV:Large Scale Chemical Industries					

	Manufacturing process – raw materials – composition and uses of products in Portland cement – ceramics – plastics, synthetic fibres –synthetic rubber – fertilizers – insecticides and pesticides – photo film industries – commercial aspects of starting an industry
	UNIT-V:Safety Signs And Colours Used In Industries – Industrial Hazards and Accidents – Classification of Hazards – Physical, chemical Biological, Ergonomic and stress Hazards – Causes, prevention and control – case study on industrial accidents – Bhopal gas Tragedy – Heat stress – sources and control – Noise pollution in industry – sources and control.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Mukhlynov (ed.), Chemical Technology, Vol.1, Mir Publication, Moscow, III edn., 1979. 2. A. K. De, Environmental Chemistry, Wiley Eastern Ltd., II edn., Meerut 1989, Chs, 5 – 7. 3. R.K. Goel, Process know-how and material of construction for Chemical Industries, S.B. Publ., Delhi, 1977. 4. B.N. Chakrabarthy, Industrial Chemistry, Oxford and IBH Publ., Now Delhi, 1984. 5. R. Norris Shreve and J.A. Brink, Jr. Chemical Process Industries, IV edn., McGraw Hill, Tokyo, 1977. 6. Industrial Safety and Environment – A.K. Gupta – University Science press, New Delhi.

Methodof Evaluation:

SessionalI	SessionalII	EndSemester Examination	Total	Grade
20	20	60	100	A,A+,B,D,D+,O

Methodsofassessment:
Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview
Application(K3)–
Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain
Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge
Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	L	S	S	S	M	M	L	M	M
CO2	M	M	S	S	S	L	L	M	L	M
CO3	M	M	S	M	S	M	L	L	M	S
CO4	M	M	M	M	S	S	L	M	L	S
CO5	M	M	S	M	S	M	L	L	L	M

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

SEMESTER **III**

Course	**Core(VII)**
CourseCode	**CHEC307**
Title of theCourse	**PHYSICAL METHODS IN CHEMISTRY**
Credits	**4**
Pre-requisites, ifany	Studentsshouldknowaboutthefundamentalaspectsonspectroscopyandtheirimportanceinthecharacterizationofchemicalcompounds.BasicknowledgeonUV-Vis,IR,NMRandMassspectroscopictechniqueswill beadvantageous.
Course Objectives	• To provide the deep understanding of electronic structural changes ofmetalcoordination complexes upon interactionwith visible light. • To understand basic theory and instrumentation involved in the origin ofspectroscopy. • To understand UV, IR, NMR and Mass spectra and their significance inthecharacterization oforganiccompounds. • To illustrate the basic principle of splitting of spectral line of inorganiccomplexesinthepresenceofmagneticfielduponinteractionwithelectromagneticradiation. • Tounderstandroleofspectroscopy(UV,IR,NMR&Massspectroscopy)todeterminethe structureof organiccompounds. • TolearnESR andtheirimportanceinthecharacterizationofradicals. • To understand basic theory & instrumentation involved with analyticaltechniquesforcharacterization and imaging
Course Outcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Interpretationofvarious absorptionbandinthevisible,IRandmicrowaveregiontounderstandthestructuralbonding,geometryandreactivityof inorganiccoordination complexes(K1-K4)
CO2	Tounderstandthebasicconcept,interpretationandapplicationofelectronicspectraofhydrogenandmanyelectron atoms alsoto deriveangular momentumofmanyelectronatoms andterm symbolsof atoms(K2-K4)
CO3	Knowledgeof crystal,vibrational,thermal,ATRandimagingmodestocharacterizechemical compounds (K3-K4)
CO4	Understandbasictheoryaswellas instrumentationtechniques for recording UV, IR,NMR,ESR,MS,XRD,Raman,MossbauerandThermalspectraofchemicalcompounds (K2-K5)
CO5	InterpretationofUV,IR, NMR,TGA,DSC,XRD,Raman,Mossbauer,ESRandMS spectraof compoundsto understandtheir structural characteristics(K2-K6)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	

I	**ELECTRONICSPECTROSCOPY(PHYSICAL&INORGANICCHEMISTRY)** Spectra of hydrogen and many electron atoms, angular momentum ofmanyelectronatoms,termsymbols,spectraofmanyelectronatoms-Zeemaneffect. Spectra of diatomic molecules, Representation of electronic statesthroughpotential energydiagrams-Frank Condonprinciple. Intensities of electronic transitions- theoretical treatment of absorptionintensities, transition dipole moment integral, oscillator strength, selectionrules parity, spin and symmetry considerations, Factors inducing forbiddentransitionsvibronic andspin orbit coupling,polarization bands. Spectraofformaldehyde,butadieneandbenzene–grouptheoreticaldiscussion. Electronic spectra of inorganic complexes – Selection rules (Laporte,orbital and spin selection rules), band intensities, band widths, spectra insolids,spectraofaqueous solutionsof d^1-d^9 ions in$O_h$and$T_d$environments.
II	**MOSSBAUER & RAMAN SPECTROSCOPY, X-RAY ANDTHERMAL METHODS OF ANALYSES (ANALYTICALCHEMISTRY)** Mossbauer spectroscopy: Introduction, principle, instrumentation, recoilenergy, Doppler effect, number of MB signals, isomer shift, quadrupolesplitting, magnetic hyperfine splitting applications to ^{57}Fe, ^{119}Sn and ^{129}Icompounds Raman Spectroscopy: SERS, SERRS. ATR techniques – UV, IR,Raman.Principle&applicationofORDandCDintheidentificationofcomplexes. 3D,4D&5D NMR imagingtechniques X-ray diffraction – Bragg equation, space groups and point groups,diffraction methods. Thermal methods of analysis – TGA, DTA and DSC –Principleand applications.

III	**NUCLEAR MAGNETIC RESONANCE(ORGANICCHEMISTRY)** Origin of NMR spectrum-Nuclear spin states – NMR active nuclei – Nuclear magnetic moment–Larmor equation – Absorption of energy andResonance– Populationdensityofnuclearspinstates.Saturationphenomena. Relaxation mechanisms, Bloch equation (only significance and derivationnotrequired).ComparisonofCWandFTinstrument–Chemicalshift-StandardsinNMR–ShieldingandDe-shielding– Factorsaffectingchemicalshift– electronegativity,hybridization,hydrogenbonding-anisotropiceffectdouble, triple bond, aromatic compounds and carbonyl compounds. Spin-spincoupling–splittingoriginandrules– factorsaffectingcouplingconstant:cis,trans,gem,ortho,meta,paracoupling–exchangewithdeuterium.Vicinityoftheproton,Longrangecoupling,Karpluseq uationandcurve. ^{1}J, ^{2}J, ^{3}J, ^{4}J and ^{5}J coupling in NMR, order of NMR spectrum. Spinsystems: Two interacting nuclei: A2, AB, AX, AA'BB', dd, pair of doublet,ABquartet.Threeinteractingnuclei:AMX,ABX, ABCsystems(onlypatternisrequired).SimplificationofcomplexNMRspectra-Lanthanideshiftreagents,CIDNPandNOE.Basicprinciplesandapplicationsof VTNMR&MRI. ^{13}CNMR–difficultiesinrecording^{13}CNMR:Homonuclearandheteronuclear coupling. Decoupling technique: SFORD and Off Resonancedecoupledspectrumidentificationofvarioustypesofcarbonusing^{13} CNMR.APT&DEPT spectra(DEPT-45, DEPT-90 and DEPT-135). ^{19}FNMRPrecessionalfrequencyandheteronuclearcoupling.Identification of organofluoro compounds (CF3CO2Et and CF3CH2OH)usingNMR.^{31}PNMR– Chemicalshiftandheteronuclearcoupling.Identificationoforganophosphorus compoundssuchas(CH3)3P,(C2H5O)2P=OandPh3P.P-PbondinNMR.Basicprinciplesof2DNMR(COSY,NOSEY,HSQC &HMBC).

IV	**UV,IR,MS(ORGANICCHEMSITRY)** Electronicabsorption-Beer-Lambertslaw,Typesofelectronicexcitation.ChromophoreandAuxochrome-BathochromicandHypsochromic shifts. UV-vis spectra of simple organic compounds such asalkenes,phenols,anilines,carbonylcompoundsand1,3-diketones.Woodward and Fieser rule for calculation of λ-max values of dienes andunsaturatedketones. InfraredSpectra:IdentificationoffunctionalgroupsinOrganicCompounds,Fingerprintregion.InterandIntramolecularhydrogenbondingOrigin,basicsandblocdiagramof Massspectrum-VarioustypesofIonizationtechniques-StabilityofMolecularions,Metastableions.BasepeaksandIsotopepeaks.Fragmentationpatternsoforganicmoleculessuchasbenzenes,phenylhalides,phenols,benzylalcohols,benzylhalides,aliphaticalcohols,aliphaticaswellasaromaticaldehydes,ketones,acids,estersandamides.Fragmentationpatternsofaliphatic/aromaticnitroandaminecompounds.Fragmentationpatternsofheterocyclicccompounds(furan,pyrroleandpyridineonly).McLaffertyrearrangementsoforganicmolecules. Structural determination of Organic Compounds using UV, IR, NMRandMass Spectra.
V	**ESR(INORGANICCHEMSITRY)** ESR Spectra of d^1-d^9 Transition Metal Complexes with examples.Interpretation of g in cubic, axial and rhombohedral geometries. Calculationof g values with simple examples. Intensities of '$g_{\parallel}$ and $g_{\perp}$ peaks. EvidenceforMetal-LigandBondCovalency-Cu(II)-Bis–Salicylaldimine,Bis-Salilcylaldoximatocopper(II)$[(NH_3)_5CoO_2CoNH_3)_5]^{5+}$,Cu(II)-diethyldithiophosphinate, Vanadyldithiophsphinate, Copper(II)tetraphenylporphyrin,Co(II)-phthalocyanine,$K_2[IrCl_6]$.Interpretationof'g'and'A' valuesfromesrspectral datain-i)MnF_6^{4-},ii) CoF_6^{4-}, andCrF_6^{3-}.
Reading List(Print andOnline)	• https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod2.pdf • https://www2.chemistry.msu.edu/courses/cem351/FS16_HUANG/Lecture_Presentation/Ch_10_Lecture_Presentation.pdf

	• https://www.slideshare.net/siraj174/sir-aj-nmr-spectroscopy-lecture • http://web.iyte.edu.tr/~serifeyalcin/lectures/chem305/cn_1.pdf • https://www.youtube.com/watch?v=qtpVfccYEHE&t=98s • http://www.digimat.in/nptel/courses/video/104106122/L54.html • https://pubs.rsc.org/en/content/articlelanding/2018/cs/c6cs00565a • https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Spectroscopy/Magnetic_Resonance_Spectroscopies/Electron_Paramagnetic_Resonance/EPR%3A_Application
Recommended Text/Reference Books	• Chang,R(1971);BasicPrinciplesofSpectroscopy,McGrawHill,ISBN-13:978-007010517 • Banwell,C.N.;McCash,E.M(1994);FundamentalsofMolecularSpectroscopy,IVthEdition,McGrawHill, ISBN0-07-707976-0 • Kemp,W.(2016);OrganicSpectroscopy,3rd Edition,Palgrave • Kalsi,P.S(2016);SpectroscopyofOrganicCompounds,7thEdition,NewAgeInternational • Silverstein,R.M,Webster,F.X,Kiemble,D.J,Bryce,D.L(2015);Spectrometric IdentificationofOrganicCompounds,8thEdition,Wiley • JagMohan(2016);OrganicSpectroscopyPrinciples&Applications,3rdEdition,NarosaPublishingHouse • Pavia,L,Lapman,G.M,Kriz,S,Vyvyan,J.-R(2015);IntroductiontoSpectroscopy,Cengage Learning,ISBN13:978-81-315-2916-4 • RussellS.Drago,R.S(2016),PhysicalMethodsforChemists,IIEdition, • Huheey,J.E.;Keiter,E.A.;Keiter,R.L.;Medhi,O.K(2006);InorganicChemistry: Principles of Structure and Reactivity, IVth Edition, PearsonEducation • Skoog, D. A; Holler, F.; Crouch, S (2017); Principles of InstrumentalAnalysis,7th Edition, Brooks/Cole publisher • Ebsworth, E. A. V.; Rankin, D. W. H.; Craddock, S (1986); StructuralMethodsinInorganicChemistry,Wiley-Blackwell,ISBN-13:978-0632015924 • Willard, H. H.; Merritt, L.L. Jr.; Dean, J.A.; Settle, F. A. Jr. (2004);Instrumental methods of analysis CBS Publishers & Distributors; 7thEdition,ISBN13: 9780534081423 • Macomber,R.S(1998);AcompleteintroductiontoModernNMRSpectroscopy,John Wiley,ISBN:0-471-15736-8

Methodof Evaluation:

SessionalI	SessionalII	End SemesterExamination	Total	Grade
20	20	60	100	A,A+,B,D, D+,O

Methodsofassessment:
Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview
Application(K3)–
Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain
Analyse (K4) – Problem-solving questions, Finish a procedure in many steps, Differentiatebetweenvarious ideas, Map knowledge
Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	M	M	M	M	M	L	M	L	L
CO2	M	M	L	M	L	L	M	M	L	L
CO3	L	L	L	M	L	M	M	L	M	L
CO4	M	M	M	S	M	M	M	L	L	L
CO5	M	M	S	S	L	M	M	L	L	L

*S-Strong;M-Medium;L-Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Course	**Core(VIII)**
CourseCode	**CHEC308**
Title of theCourse	**BIOORGANIC CHEMISTRY**
Credits	**4**
Pre-requisites, ifany	Studentsshouldknowaboutthefundamentalaspectsonspectroscopyandtheirimportanceinthecharacterizationofchemicalcompounds.BasicknowledgeonUV-Vis,IR,NMRandMassspectroscopictechniqueswill beadvantageous.
Course Objectives	• To provide the deep understanding of electronic structural changes ofmetalcoordination complexes upon interactionwith visible light. • To understand basic theory and instrumentation involved in the origin ofspectroscopy. • To understand UV, IR, NMR and Mass spectra and their significance inthecharacterization oforganiccompounds. • To illustrate the basic principle of splitting of spectral line of inorganiccomplexesinthepresenceofmagneticfielduponinteractionwithelectromagneticradiation. • Tounderstandroleofspectroscopy(UV,IR,NMR&Massspectroscopy)todetermine the structureof organiccompounds. • TolearnESR andtheirimportanceinthecharacterizationofradicals. • To understand basic theory & instrumentation involved with analyticaltechniquesforcharacterization and imaging
Course Outcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Interpretationofvarious absorptionbandinthevisible,IRandmicrowaveregiontounderstandthestructuralbonding,geometryandreactivityof inorganiccoordination complexes(K1-K4)
CO2	Tounderstandthebasicconcept,interpretationandapplicationofelectronicspectraof hydrogenandmanyelectron atoms alsoto deriveangular momentumofmanyelectronatoms andterm symbolsof atoms(K2-K4)
CO3	Knowledgeof crystal,vibrational,thermal,ATRandimagingmodestocharacterizechemical compounds (K3-K4)
CO4	Understandbasictheoryaswellas instrumentationtechniques for recording UV, IR,NMR,ESR,MS,XRD,Raman,MossbauerandThermalspectraofchemicalcompounds (K2-K5)
CO5	InterpretationofUV,IR, NMR,TGA,DSC,XRD,Raman,Mossbauer,ESRandMS spectraof compoundsto understandtheir structural characteristics(K2-K6)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	**Carbohydrates (15 Hours**) Introduction, Classification, Determination of configuration and ring size of D-

	glucose and D-fructose, Ferrier, Hanesian reactions and Ferrier rearrangement, Determination of structure and ring size of sucrose and maltose, Structure and biological functions of starch and cellulose.
II	**Vitamins (15 Hours)** Vitamins-Structural elucidation and synthesis of Retinol, Thiamine, Riboflavin, Pyridoxin, Pantothenic acid, Ascorbic acid, Tocopherols, Vitamin K, Cyanocobalamine.
III	**Terpenoids and Carotenoids (15 Hours)** Terpenoids – Structural elucidation and synthesis of Menthol, Abietic acid, Squalene and Phytol. Carotenoids – Synthesis of Alpha Carotene, Beta Carotene and Vitamin A2.
IV	**Nucleic acid and Lipids (15 Hours)** Nucleic acid – Structure and synthesis of Nucleosides and Nucleotides, Primary, Secondary and Tertiary structure of DNA, Types of RNA and their structures, Replication, Transcription, Translation, Genetic code and Finger printing. Lipids – Introduction, Classification, Chemical synthesis and Biosynthesis of Phospholipids and Glycolipids.
V	**Proteins, Enzymes and Coenzymes (15 Hours)** Proteins- Biological importance, Peptide synthesis by solid phase and solution phase methods. Enzymes- Definition, Classification, Mechanism of enzyme action- lock & key model, induced Fit theory and substate strain theory and Mechanism of enzyme catalysis. Coenzymes- Introduction, Classification, Structure and biological functions of Coenzyme A, Thiamine pyrophosphate (TPP), Pyridoxal phosphate (PLP), Flavin adenine nucleotide FAD, FADH2 and Adenosine triphosphate (ATP)
Recommended Text/Reference Books	1. G. Chatwal, Organic Chemistry of Natural Products, Volume I and II, Himalaya Publishing House,1988. 2. O.P. Agarwal, Chemistry of Organic Natural Products, Volume I and II, Goel Publishing House,1988. 3. I.L. Finar, Organic Chemistry, Volume II, 5th Edition, First Indian reprint, Pearson Education Asia Private Ltd.,2000. 4. V.K. Ahluwalia, Chemistry of Natural Products, Ane Books Pvt.Ltd, 1st Edition,2006. 5. U. Satyanaraya, Biochemistry, Uppala Author- Publisher Interlinks, Vijayawada 2nd Edition,2003. 6. J.L.Jain,FundamentalofBiochemistry,S.ChandandCo,NewDelhi,2007.

Methodof Evaluation:

SessionalI	SessionalII	End SemesterExamination	Total	Grade
20	20	60	100	A,A+,B,D, D+,O

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview

Application(K3)–

Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain

Analyse (K4) – Problem-solving questions, Finish a procedure in many steps, Differentiatebetweenvarious ideas, Map knowledge

Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	M	M	M	M	L	M	L	L
CO2	M	M	L	M	L	L	M	M	L	L
CO3	L	L	L	M	L	M	M	L	M	L
CO4	M	M	M	S	M	M	M	L	L	L
CO5	M	M	S	S	L	M	M	L	L	L

*S-Strong;M-Medium;L-Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Course	**Core(IX)**
CourseCode	**CHE C309**
Title of theCourse	**ORGANIC CHEMISTRY PRACTICAL II– DOUBLESTAGEORGANICPREPARATIONS AND ESTIMATION**
Credits	**3**
Pre-requisites, ifany	Basicknowledgeonsimpleorganicpreparationswillbeessential
Course Objectives	Themain objectives ofthis courseareto: ● Toprovidepracticaltrainingon doublestageorganicpreparations ● Learnaboutthepurificationtechniquesoforganiccompoundsbyrecrystallization and column chromatography ● Tounderstandthemechanismandintermediatesinorganicreaction. ● Tocharacterizethe structureof thepurifiedorganiccompoundbyIRandNMR.
Course Outcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Gain practical skills on double stage preparations of organic compounds(K1-K6)
CO2	Monitoringthe progressof thereaction byTLC(K2-K5)
CO3	Haveexperienceonpurification of organic compoundsbyrecrystallization orcolumn chromatography(K2-K4)
CO4	Getadequate knowledgeinsynthetic organic chemistry(K3-K5)
CO5	Characterization of prepared compounds by IR, ^{1}H NMR and Mass spectra(K2-K5)
K1-Remember;**K2**-Understand;**K3-**Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	**DOUBLESTAGEORGANICPREPARATIONS** 1. SynthesisoforganiccompoundsinvolvingFriedel-Craftsalkylationandacylation reactions 2. Synthesisof nitrocompounds 3. Synthesisofhalogenatedcompounds 4. Synthesisofaldehydesinvolvingformylationreactions 5. SynthesisoforganiccompoundsbyusingPd-catalyzedcouplingreactions 6. Synthesisoforganiccompoundsinvolvingnucleophilicsubstitution reactions

II	**UNIT-II:Estimations:** a) Estimation of Phenol (bromination) b) Estimation of Aniline (bromination) c) Estimation of Ethyl methyl ketone (iodimetry) d) Estimation of Glucose (redox) e) Estimation of Ascorbic acid (iodimetry) f) Estimation of Aromatic nitro groups (reduction)
Reading List(Print andOnline)	• OrganicChemistrynotes: YouTube https://www.youtube.com/watch?v=N96JaRnE7n0YouTube:https://www.youtube.com/watch?v=0RwDowIgXqk
Recommended Text/Reference Books	• Furniss,B.S.;Hannaford,A.J.;Smith,P.W.G.;&Tatchell,A.R.(2003);Vogel's Textbook of Practical Organic Chemistry, 5th Edition., PearsonEducation • Mohan, J. (2010); Organic Analytical Chemistry, Theory and Practice,Narosa. • Mann,F.G&Saunders,B.C.(2009);PracticalOrganicChemistry,fourthedition, Pearson EducationIndia • Gnanaprakasam,N.S.&Ramamurthy,G.(2009);OrganicChemistryLabManual,Viswanathan, S.,Printers &PublishersPvtLtd • Ahluwalia,V.K.Bhagat,P.&Aggarwal,R.(2013);LaboratoryTechniquesinOrganicChemistry,IKInternationalPublishingHouse Pvt.Ltd

Methodof Evaluation:

Internal	EndSemesterExamination	Total	Grade
30	20	50	A,A+,B,D,D+,O

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview

Application(K3)–

Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain

Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge

Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	L	M	M	M	M	M	M
CO2	M	L	L	M	M	M	M	M	M	M
CO3	S	L	M	L	M	M	M	M	S	S
CO4	M	M	M	M	M	L	L	S	L	L
CO5	L	M	S	M	L	M	M	L	L	L

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Course	**Elective(V)**
CourseCode	**CHEE305**
Title of theCourse	**BIOLOGICALCHEMISTRY**
Credits	**3**
Pre-requisites, ifany	Student able to understand the role of bio-organic compounds. Studentsshouldknowaboutthefundamentalaspectsonbiologicalsystem,mechanism,kinetics andanalytical tools.
Course Objectives	• Tounderstandthefunctionofcarbohydrateinbiologicalchemistry,determinationofringsizeand studyof starch andcellulose. • Tounderstandthesignificancesofaminoacids,proteinsnucleicacidsinbiologicalsystem. • Illustrate the importance of the various elements in the biological systemand to gain more insights into the binding of metal complexes withbiomacrmolecules and transport and storage mechanism involving in themetaloenzymes. • To understand the role of heavy metals in the human body- therapeuticand toxicitylevels.
Course Outcomes	On the successful completion of the course, students will acquireknowledge:
CO1	To learn about structural and functions of carbohydrates, lipids, membranes,aminoacids,proteins, antibioticsand vitamins(K1-K5)
CO2	Understandstructureandbiologicalimportanceof RNAandDNA(K2-K4)
CO3	Understand the key function of metal ions such as Fe, Co, Ni Zn and Cu inliving system, particularly in transports (energy and O_2), storage, electron- and proton transfer, hydrolysis, etc. which are taking place at the active siteofmetalloproteins and enzymes (K1-K4)
CO4	Toxicityof metalsand their effectsin the biologicalsystem (K1-K4)
CO5	Toevaluatetoxicityofdrugsusedin cancerandradiodiagnosis (K5&K6)
K1-Remember;**K2**-Understand;**K3-**Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
	BIOLOGICALCHEMISTRY

I	**Carbohydrates**:Pyranoseandfuranoseformsofaldo-hexoseandketohexose-methods used for the determination of ring size-conformation ofaldo-hexopyranose-structure and synthesis of lactose and sucrose. A briefstudyof starch andcellulose. **LipidsandMembranes**:Molecularstructureoflipids.FattyAcids,TriglyceridesTypesof membranelipids **Amino acids and Proteins:** Amino acids and Protein structure, Analysis ofN-terminalandC-terminalsinapolypeptide.Sangermethod,EdmandegradationandEnzymaticanalysis.Primary,secondaryandtertiarystructureofproteins. Structureof collagen, myoglobinandhaemoglobin. **Nucleic acids: C**hemistry of nucleic acids, nucleosides and nucleotides – StructureRNAand DNAandtheirbiological importance. **Biomolecules:Antibioticsandvitamins:** Adetailedstudyofstructure,andstereochemistry of penicillin, cephalosporin. Chemistry and physiologicalaction of ascorbic acid, thiamin, riboflavin and pyridoxine – Elementaryaspectof vitamin A, E, Kand B12.
II	**Nucleic acids: C**hemistry of nucleic acids, nucleosides and nucleotides – StructureRNAand DNAandtheirbiological importance. **Biomolecules:Antibioticsandvitamins:** Adetailedstudyofstructure,andstereochemistry of penicillin, cephalosporin. Chemistry and physiologicalaction of ascorbic acid, thiamin, riboflavin and pyridoxine – Elementaryaspectof vitamin A, E, Kand B12.
III	**BIO-INORGANICCHEMISTRY** Essentialandtracemetalions:Enzymes-Nomenclatureandclassification-Coenzymes-VitaminB12,CarboxypeptidaseandSuperoxidedismutaseHeme-enzyme-Peroxidaseandcatalases.Oxygencarriers:Hemeproteins- Hemoglobin, myoglobin - Structure Oxygenation and stereochemistry -Bohr effect. Non-hemeoxygen carriers - Hemerythrin and hemocyanin.Nitrogen fixation: Introduction, types of nitrogen fixing microorganisms.Nitrogenaseenzyme-Metalclustersinnitrogenase-redoxproperty-Dinitrogen complexes - transition metal complexes of dinitrogen - nitrogenfixationvianitrideformationandreductionofdinitrogentoammonia.Biologicalredoxsystems:Cytochromes-Classification,cytochromea,bandc.CytochromeP-

	450.Transportofelectrons:Iron-SulphurProteins:RubredoxinsandFerredoxins,StructuralandSpectralfeaturesof Iron-SulphurProteins. Photosynthesis andchlorophyll's.
IV	**BIO-PHYSICALCHEMISTRY** Thermodynamicsandbiology-Basicconceptsofstructureandfunctionality-membranes-structure, function transport properties, aspects ofelectrochemicalphenomena– activetransport,ionophores,biologicalenergystorage systems – stepwise mechanism of photosynthesis versus potential.Enzymes-Nomenclatureandclassification,chemicalkinetics,thefreeenergyofactivationandtheeffectsofcatalysts,kineticsofenzymecatalyzedreactions – Michaelis - Menten equation - Effect of pH, temperature onenzymereactions,Factorscontributingtothecatalyticefficiencyofenzymes.Membranes- PhaseEquilibria, Donnaneffect,Donnan Potential, PhasetransitioninLipidbilayers,FreeenergydeterminationforATPhydrolysis from sodium-potassium pump, Allosteric effects – Monod-Wyman-ChangeuxTheory,AssigningofStatisticalweightsforHelix-Coiltransitionin proteins, Studybyspectroscopic methods.
V	**BIO-ANALYTICALCHEMISTRY** Essentials of trace elements and chemical toxicology: Trace elements inbiological system. Metal ion toxicity - classes of toxic metal compounds– detoxification. Metals in medicine: Anti-arthritis drugs – Au and Cu inrheumatoid arthritis – Li in psychiatry – Pt, Au and metallocenes in anti-cancerdrugs-metalsinradiodiagnosis,radiotherapyandmagneticresonance imaging. Transport and storage of metals: Mechanism – Fe, Cu,Zn and V storage and transport – metallothioeins. Molecular mechanism ofiron transport across the membrane – sodium and potassium ion pumps.Pollutionstudies– Effluent andwatertreatment.
Reading List(Print andOnline)	• https://www.youtube.com/watch?v=iuW3nk5EADghttps://www.youtube.com/watch?v=aeC7M9PDjQwhttps://www.youtube.com/watch?v=DhwAp6yQHQIhttps://www.youtube.com/watch?v=ZqoX2W1N6l0 • https://www.youtube.com/watch?v=lsNalwRnaq0&list=PLbMVogVj5nJSHhL_cMKfzLv556ddrIT90 • https://www.youtube.com/watch?v=pXztk04J7u0&list=PLFW6lRTa1g83-gUOcT3ay875UG3a9Mu11

Recommended Text/Reference Books	• Zubay,G,L.(1997);Biochemistry,4thEdition,Brown(WilliamC.)Co • Nelson,D,LLehninger,A,LCoxM,M.(2008);PrinciplesofBiochemistry,5th Edition,New York: W.H.Freeman. • JohnMcMurray,(2008); OrganicChemistry,8thEdition,Brooks/Cole. • Finar,I.L.Vol2(2018);OrganicChemistry:StereochemistryandtheChemistry of Natural product,IIIrdEdition,Pearson • WilliamsD.R.(1976);IntroductiontoBioinorganicChemistry,Thomas,ISBN-13: 978-0398034221. • Kaim,W,Schwederski,B,Klein,A.(2013);Bioinorganicchemistry:InorganicElements inthe chemistryoflife,2ndEdition, Wiley. • DasAsimK.(2007);BioinorganicChemistry,1stEdition,BooksandAllied(P)Limited. • MugherjeeG.N,ArabindaD,(1993);ElementsofBioinorganicChemistry,4thEdition, U.N. Dhur&Sons Pvt.Ltd. • SatakeM.MidoY.(1996);BioinorganicChemistry,ISBN81-7141-301-1,DiscoveryPublishing House, NewDelhi. • Eichorn,G,(1973);InorganicBio-ChemistryVol.IandII,IVEdition,Elsevier. • Zhimin,T,(2008);AnalysisofCytotoxicityofAnticancerDrugs,VDMVerlagDr. Mueller E.K.ISBN: 9783639063486, 3639063481

Methodof Evaluation:

SessionalI	SessionalII	End SemesterExamination	Total	Grade
20	20	60	100	A, A+, B, D,D+,O

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview

Application(K3)–

Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain

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MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	L	M	M	M	M	M	L	M
CO2	L	M	L	S	L	M	L	M	M	M
CO3	L	L	M	S	L	L	M	L	L	M
CO4	L	L	L	M	L	M	L	M	L	L
CO5	M	L	M	M	L	L	M	L	L	S

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="6">SKILL ENHANCEMENT COURSE-II (SEC-II)
SOFTWARE PACKAGE FOR CHEMISTS – MATLAB, ORIGIN AND CHEMDRAW</td></tr>
<tr><td>Paper No.</td><td colspan="6">AECC-II</td></tr>
<tr><td>Category</td><td>SEC-II-</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td></tr>
<tr><td></td><td></td><td>Semester</td><td>I</td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>2</td><td></td><td colspan="2">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="6">Basic concepts of Software Package</td></tr>
<tr><td>Objectives of the course</td><td colspan="6">To provide basic knowledge in Software Package chemistry and Matlab, Origin And Chemdraw</td></tr>
<tr><td>Course Outline</td><td colspan="6">UNIT I
Handling of Variable, Comments and Functions: (6 Hours)
Basic concepts of MATLAB and its applications in various filed – History and its various Basic operation – Important functions – understanding variables – different types of variables – creating Scripts and understanding commends – operation on matrix – File handling and text processing
UNIT-IIProgramming and Data Conversion: (6 Hours)
Programming in MATLAB – Plot functions and programming – 2-D plots (two vectors) and 3-D plots with three vectors – Additional 2D plots – working with structure and map container data types – cell data types – converting between different data types
UNIT-IIIBasics of Origin: (6 Hours)
Spread sheets – Basic of origin – various mathematical functions for plotting, statistical calculations – Drawing of various plots and its functions – Background correction for various plots
UNIT-IVOrigin for Data Analysis: (6 Hours)
Curve fitting using polynomial, exponential, Gaussian, Lorrentzian, Boltzmann, reciprocal functions, Computing area under a curve, peak finding, deconvolution of curve– Bar chats-3D plotting – error bars in plotting
UNIT-VChemdraw: (6 Hours)
Basic concepts of chemdraw – Functions – various arrows used in the chemical equations – concept of drawing of chemical equations – Concepts of valance of atoms in a molecules– Drawing of simple molecules, macro molecules, inorganic complex, organometallic complex, peptides anddendrimers –</td></tr>
</table>

	drawing of catalytic cycles and organic reaction mechanism. Text book: 1. Amos Gilat, MATLAB: An Introduction with Applications, 4ed , 2012 2. S.N. Alam, S.S. Alam, Understanding Matlab: A Textbook for Beginners, 2019, Dreamtech Press 3. Jake Woods, Chemdraw Professional (Tutorial User Guide) Kindle Edition, 2019.

Methodof Evaluation:

SessionalI	SessionalII	End SemesterExamination	Total	Grade
20	20	60	100	A, A+, B, D,D+,O

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview

Application(K3)–

Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain

Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge

Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	L	M	M	M	M	M	L	M
CO2	L	M	L	S	L	M	L	M	M	M
CO3	L	L	M	S	L	L	M	L	L	M
CO4	L	L	L	M	L	M	L	M	L	L
CO5	M	L	M	M	L	L	M	L	L	S

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

SEMESTER **IV**

Course	**Core(XI)**
CourseCode	**CHEC410**
Title of theCourse	**ORBITAL SYMMETRY, PHOTOCHEMISTRY, AROMATICITYAND NON-CONVENTIONAL TECHNIQUES IN ORGANICSYNTHESIS**
Credits	**4**
Pre-requisites, ifany	Basic knowledge on molecular orbitals, photochemistry and non-conventionaltechniqueswill beessential.
Course Objectives	Themain objectives ofthis courseareto: • Understandtheconceptofpericyclicreactionsandanalysisofthesymmetry of the molecular orbitals to predict allowed and forbiddenreactions. • Abletopredictthecon-rotatoryanddis-rotatoryelectrocyclicring-openingandring-closurereactionsalongwithstereochemicaloutcomeofthereactions under thermal andphotochemical conditions. • Understand the mechanisms of different types of pericyclic reaction:cycloadditions, electrocylic reactions, sigmatropic reactions and grouptransfer reactions. • Realizetheconceptofphotochemistryandreactionsalongwithsyntheticutilityof variousPhotochemical Reactions • Tolearncriteriaforaromaticityandeffectofstructureonreactivityoftheorganicco mpounds • To understand basic principles (green chemistry/atom economy)andapplications of non-conventional techniques and their comparison withconventionalmethods oforganic synthesis
Course Outcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Learn about different aspects of pericyclic reactions and skills for theutilizationofthesereactionsin theorganic synthesis(K1-K5)
CO2	Ableto predictthe relevant*con*-rotatoryand *dis*-rotatoryrotationin electrocyclicring-openingandring-closurereactions (K2-K4)
CO3	To understand reaction feasibilityand selectivitybyapplyingtheWoodward–Hoffmannrules (K1-K6)
CO4	Understandthe conceptsof photochemistryandtostudythesynthesis & applicationsofvarious typesofphotochemicalreactions (K1-K5)
CO5	Abletoidentifyaromatic,non-aromatic andanti-aromaticsystems; To understand basic principles, importance and applications of non-conventionaltechniques(K1-K6)
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	

I	**BASICCONCEPTOFMOLECULARORBITALTHEORYANDPERI CYCLICREACTION IN ORGANIC REACTIONS** Basic concept of conservation of orbital symmetry, electrocyclic andcycloaddition reactions, correlation diagram, FMO, PMO treatment. Ringclosurereactionfocusingsystemsuchasbutadiene,pentadienylanion,pentadienylcation, allyl anion, allylcation, hexatriene, heptatrienylcation,heptatrienylanion,andoctatetraene.Applicationofelectrocyclicreactionsinsynthesisofterpenes,steroidsandalkaloids.Stereoselectivity,regioselectivity,periselectivity andsiteselectivity incycloaddition.1,3-dipolar cycloaddition, click reaction, 2 + 2, 4 + 2, 4 + 4, 6 + 2, and 6 + 4cycloadditionreactions.Secondaryorbitalinteractionsincycloadditions.Normaland InverseelectrondemandDiels-Alderreaction.
II	**PERICYCLICREACTIONINORGANICREACTIONS** Sigmatropic and Cheleotropic reactions, correlation diagram, FMO &PMO treatment. Hydrogen migration. Carbon migration with symmetric andasymmetric centre. C-C bond migration, Orbital treatment for Cope, Claisenand 2,3-Sigmatropic reaction. Extrusion of CO_2, CO, SO_2 orbital symmetrytreatment.ApplicationsofSigmatropicandCheleotropicreactionsinorganicsynthesis.Combinationofcheleotropicreactionwithcycloaddition.
III	**ORGANICPHOTOCHEMISTRY** Organic photochemistry: Principles of photochemistry, Fate of excitedstate: Physical and Chemical process; [2 + 2] photochemical cycloaddition;Paterno-Büchi reaction; Photochemistry of cyclohexadienones, Norrish typeI & II reactions. Oxidation and reduction reactions: Reaction with singletoxygen.Selectedreactions:PhotoFries,Barton,di-πmethane,oxa&azadi-πmethanerearrangements.
IV	**AROMATICITYAND NON-CONVENTIONALTECHNIQUES** Aromaticity-Study of benzenoid and non-benzenoids compounds in thelightof Huckel's rule. Aromaticityof annulenes. Basicprinciplesofnon-conventionaltechniques:Microwave,Sonication, Ball-milling techniques in organic reaction. Organic reactions inaqueous phase; Ionic liquids and their applications in organic synthesis.Tandem,cascadeanddominoreactionsinorganicsynthesis.Concept of

	greenchemistry. Atomeconomy.
V	**Retrosynthesis and Protecting groups (15 Hours)** Retrosynthetic Analysis – Definition, Synthon approach, Synthetic equivalent reagent, Functional group interconversion, Linear and Convergent method in organic synthesis. Disconnection approach – one group disconnection. Retro synthesis of Alcohols, Olefins, Aliphatic and Aromatic Ketones and Retro Diels – Alder reaction Producting groups – Production of Alcohols, 1, 2 – diols, Amines, Carbonyls and Carboxylic acids**.**
Reading List(Print andOnline)	• Organic Chemistry Portal:https://organicchemistrydata.org/hansreich/resources/pericyclic/?page=pericyclic00%2F
	• Organic Synthesis Portal:http://www.stereoelectronics.org/webPR/PR_home.html • Organic Chemistry Videos:https://nptel.ac.in/courses/104/106/104106077/https://nptel.ac.in/courses/104/105/104105038/ https://courses.mookit.in/course/course009
Recommended Text/Reference Books	● Singh,J(2019);PhotochemistryandPericyclicReactions,NewAgeInternationalPublishers. ● Sankararaman,S(2005);PericyclicReactions-ATextbook:Reactions,Applicationsand Theory,Wiley-VCH. ● Halton,B&Coxon,J.M(2011);OrganicPhotochemistry,CambridgeUniversityPress. ● Kumar,S.Kumar,V&Singh,S.P(2015);PericyclicReactions,IEdition,AcademicPress. ● Norman,R.O.C&Coxon,J.M(1993);PrinciplesofOrganicSynthesis,IIEdition, CRC Press. ● Finar,I.L.(2002);OrganicChemistryVol2:StereochemistryandtheChemistryofNaturalproduct,5th Edition,PearsonEducationIndia. ● Bruice,P.Y.(2014);OrganicChemistry,7thEdition,DorlingKindersley (I) PvtLtd ● Fleming,I(2009);MolecularOrbitalsandOrganicChemicalReactions-StudentEdition,Wiley. • Carey,F.A.&Sundberg,R.J.(2008);AdvancedOrganicChemistry-PartAand B,V Edition, Springer. • Clayden,J,Greeves,N,Warren,S&Wothers,P(2000);OrganicChemistry,Oxford UniversityPress.

	● Warren,S(2008)OrganicSynthesis, 2Edition,Wiley. ● Corey,E.J &Cheng, X-M(1995);The LogicsofChemicalSynthesis,IEdition, Wiley.

Methodof Evaluation:

SessionalI	SessionalII	End SemesterExamination	Total	Grade
20	20	60	100	A, A+, B, D,D+,O

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) – MCQ, True/False, Short essays, Concept explanations, Shortsummaryor overview

Application(K3)–

Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems,Observe,Explain

Analyse(K4)–Problem-solvingquestions,Finish aprocedureinmanysteps,Differentiatebetweenvarious ideas, Map knowledge

Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	L	S	S	M	L	M	L	M
CO2	M	M	L	S	S	M	M	L	L	L
CO3	L	M	M	S	M	M	L	L	L	M
CO4	M	M	M	S	S	M	M	L	L	S
CO5	L	M	M	S	M	L	M	L	L	S

***S-StrongM-Medium L-Low**

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3

CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Course	**Core(XII)**
CourseCode	**CHE C411**
Title of theCourse	**CHEMISTRYOFNATURALPRODUCTS**
Credits	**4**
Pre-requisites, ifany	Studentsshouldknowabouttheroutineorganicnamereactionsandbasicsynthetictransformations
Course Objectives	• UnderstandingdifferenttypesofTotal Synthesisandtheirimportance • RealizingtheimportanceofNaturalProductsandtheirBiologicalSignificance • AcquiringknowledgetodesignanyTargetedSynthesis • AnalyzingRetrosyntheticpatternanddesigningTotalSynthesisofnaturalproducts • Understandingtheroleofkeyreactionindesigningskeletalframeworkofnatural products • Understandingthebiosyntheticpatternofnaturalproducts
Course Outcomes	Onthesuccessfulcompletion ofthe course,student willbeableto:
CO1	Design retro-syntheticpattern ofanygiventargetcompound(K1-K3)
CO2	Wellversedwithdesignandtotalsynthesisofnaturalproducts(K2-K4)
CO3	Understandthesignificanceofthekeyreactionsin assemblingskeletalframeworkofnatural products (K3-K5)
CO4	Learn aboutthesyntheticutilityoforganicreactions toachievethetotal synthesisofnaturalproducts(K2-K6)
CO5	Understandthe biosyntheticpattern ofanygiven natural products(K2-K6)
K1-Remember;**K2**-Understand;**K3-**Apply;**K4**-Analyze; **K5**-Evaluate;**K6**-Create	
Units	
I	**ALKALOIDS** TotalSynthesisofthefollowingalkaloids:Preussin,Swainsonine,Horsifiline,Epibatidine,Camptothecin,Ellipticine,IbogamineandReserpine(Racemic as wellas Chiral Syntheseswhereverapplicable)
II	**STEROIDS** TotalSynthesisofSteroids:Androsterone,Testosterone,Estrone,Estradiol, 2-Methoxyestradiol and Progesterone (Racemic as well as ChiralSynthesis wherever applicable). Conversion of Cholesterol into the abovementioned steroids. Chiral as well as Racemic synthesis of ProstaglandinsPGE1,PGE2 and PGE3
III	**TERPENES** Total Synthesis of Terpenes: Cedrene, Caryophyllene and

	Longifolene(RacemicaswellasChiralSynthesiswhereverapplicable).Menthol,Hirsutene, Capnellene, Silphiperfolene and 5-Oxosilphiperfolene (Racemicaswell as ChiralSyntheses whereverapplicable).
IV	**BIOSYNTHESIS** BiosynthesisofAlkaloids,Steroids,Terpenes andProstaglandins.
V	**ANTHOCYANINS** General nature of anthocyanins, structure of anthocyanidins, synthesis of pelargonidin chloride, cyanidin chloride, delphinidin chloride and peonidinchloride.Synthesis and structural elucidation of flavones and isoflavones.
Reading List(Print andOnline)	• https://organicchemistrydata.org/hansreich/resources/syntheses/?page=abscisic-acid-constantino%2F • https://people.chem.umass.edu/mcdaniel/chem269/experiments/trimyristin/Natural-product-synthesis-an-art.pdf • https://authors.library.caltech.edu/25034/31/BPOCchapter30.pdf • https://w3pharm.u-shizuoka-ken.ac.jp/~yakuzo/pass-eng/pdf-eng.html
Recommended Text/Reference Books	• Finar,I.L.Vol2(2018);OrganicChemistry:StereochemistryandtheChemistryofNatural product,IIIrdEdition,Pearson • Carey,F.A.&Sundberg,R.J.(2015);AdvancedOrganicChemistry-PartA&B, VthEdition, Springer,ISBN 978-81-322-0426-8 • NormanR.O.C&Coxon,J.(2017);PrinciplesofOrganicSynthesis,3rdEdition,CRCPress • Wyatt,P&Warren,S.(2013);OrganicSynthesis:StrategyandControl,Wiley • Corey,E.J&Cheng,X.-M(2011);TheLogicsofChemicalSynthesis,VCH, ISBN: 978-81-265-3034-2 • Nicolau,K.C&Sorenson,E.J(1996);ClassicsinTotalSynthesis,VCH,ISBN:978-3-527-29231-8

Methodof Evaluation:

SessionalI	SessionalII	EndSemester Examination	Total	Grade
20	20	60	100	A,A+,B,D, D+,O

Methodsofassessment:

Recall(K1)–Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

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Evaluate (K5) – Longer essay/ Evaluation essay, Critique or justify with pros and cons**Create(K6)–** Checkknowledgeinspecificor offbeatsituations,Discussion, DebatingorPresentations

MappingwithProgrammeOutcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	S	M	S	L	M	M	S
CO2	M	S	L	S	S	M	L	M	L	M
CO3	L	S	L	S	S	M	M	L	M	M
CO4	M	S	L	S	S	S	M	L	M	M
CO5	L	M	S	M	S	M	L	L	L	M

*S-Strong;M-Medium;L-Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="7">ANALYTICAL INSTRUMENTATION TECHNIQUE PRACTICAL(Industry Entrepreneurship)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">4</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7"></td></tr>
<tr><td>Objectives of the course</td><td colspan="7">To design chromatographic methods for identification of species.
To analyze different constituents through instrumental methods of analysis.
To evaluate different contaminants in materials using turbidimetry and conductivity measurements.
To analyze constituents in materials using emission and absorption techniques.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I:
1. Determination of the equivalent conductance of a weak acid at different concentrations and verifying Ostwald dilution law. Calculation of the dissociation constant of the acid.
2. Determination of the equivalent conductance of a strong electrolyte at different concentrations and examining the validity of the Onsager’s theory as limiting law at high dilutions.
3. Conductometric titration of a mixture of HCl and CH_3COOH VsNaOH.
4. Conductometric titration of NH_4Cl VsNaOH.
5. Conductometric titration of CH_3COONa VsHCl.
6. Potentiometric titration of a mixture of HCl and CH_3COOH VsNaOH
7. Determination of pK_a of weak acid by EMF method.
8. Potentiometric titration of FAS Vs $K_2Cr_2O_7$
9. Potentiometric titration of KI Vs $KMnO_4$.
10. Potentiometric titration of a mixture of Chloride and Iodide Vs $AgNO_3$.
11. Determination of the pH of buffer solution by EMF method using Quinhydrone and Calomel electrode.
12. Study of the inversion of cane sugar in the presence of acid by Polarimetric method.</td></tr>
<tr><td colspan="7">UNIT-II
1.Estimation of Fe, Cu and Ni by colorimetric method.
2.Estimation of Na and K by flame photometric method.
1. Determination of spectrophotometrically the mole ratio of the ferrithiocyanate complex and equilibrium constant for the complex formation.
2. Determination of the amount (mol/L) of ferricyanide present in the given solution using cyclic voltammetry.
3. Determination of the diffusion coefficient of ferricyanide using cyclic voltammetry.</td></tr>
</table>

	4. Determination of the standard redox potential of ferri-ferrocyanide redox couple using cyclic voltammetry. 5. Estimation of the amount of sulphate present in the given solution using Nephelometricturbidimeter. 6. Estimation of the amount of nitrate present in the given solution using spectrophotometric method. 7. Heavy metal analysis in textiles and textile dyes by AAS 8. Determination of caffeine in soft drinks by HPLC 9. Analysis of water quality through COD, DO, BOD measurements. 10. Assay of Riboflavin and Iron in tablet formulations by spectrophotometry 11. Estimation of chromium in steel sample by spectrophotometry 12. Determination of Stern-Volmer constant of Iodine quenching by fluorimetry 13. Determination of ascorbic acid in real samples using Differential Pulse Voltammetry and comparing with specifications 14. Separation of (a) mixture of Azo dyes by TLC (b) mixture of metal ions by Paper chromatography 15. Estimation of chlorophyll in leaves and phosphate in waste water by colorimetry.
	UNIT-III: Interpretation and identification of the given spectra of various organic compounds arrived at from the following instruments 1.UV-Visible 2.IR 3.Raman 4.NMR 5.ESR 6.Mass etc.,
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	*1.* Vogel's Text book of Practical Organic Chemistry, 5th Ed, ELBS/Longman, England, 2003. 2. G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney, *Vogel's Textbook of Quantitative Chemical Analysis*; 6th ed., ELBS, 1989. 3. J. D. Woollins, *Inorganic Experiments*; VCH: Weinheim, 1995. 4. B. Viswanathan and P.S.Raghavan, Practical Physical Chemistry, Viva Books, New Delhi,2009. 5.Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.

Reference Books	1. N. S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Labmanual, S. Viswanathan Co. Pvt. Ltd, 2009. 2. J. N. Gurtu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 2011. 3. J. B. Yadav, Advanced Practical Physical Chemistry, Goel Publishing House, 2001. 4. G.W. Garland, J.W. Nibler, D.P. Shoemaker, Experiments in Physical Chemistry, 8th edition, McGraw Hill, 2009. 5. J. N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987.
Website and e-learning source	1. https://bit.ly/3QESF7t 2. https://bit.ly/3QANOnX
Course Learning Outcomes (for Mapping with POs and PSOs) Students will be able: CO1: To recall the principles associated with various inorganic organic and physical chemistry experiments CO2: To scientifically plan and perform all the experiments CO3: To observe and record systematically the readings in all the experiments CO4: To calculate and process the experimentally measured values and compare with graphical data. CO5: To interpret the experimental data scientifically to improve students efficiency for societal developments.	

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
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CO3	3	3	3	3	3
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CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">SKILL ENHANCEMENT COURSE- IV
PROFESSIONAL COMPETENCY SKILL ENHANCEMENT COURSE</td></tr>
<tr><td>Paper No.</td><td colspan="8">SEC</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC-III</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td></td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basic concepts of Professional Competency Skill Enhancement</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">To provide basic knowledge Professional Competency</td></tr>
<tr><td>Course Outline</td><td colspan="8">Professional Competency Skill Enhancement Course Training for Competitive Examinations
• Chemistry for NET/UGC-CSIR/SET/ TRB Competitive Examinations(2hours)
• General Studies for UPSC/TNPSC/OtherCompetitiveExaminations(2hours)
OR
Chemistry for Advanced Research Studies(4hours)</td></tr>
</table>