MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI-12

PG-COURSES–AFFILIATED COLLEGES

M. Sc
CHEMISTRY

(Choice Based Credit System)

SYLLABUS

FROM THE ACADEMIC YEAR
2026-2027

MSU

MANONMANIAMSUNDARANARUNIVERSITYTIRUNELVELI PG
- COURSES – AFFILIATED COLLEGES

M.Sc.CHEMISTRY

(Choice Based Credit System)
(Forthosewhojoinedfrom2026-2027onwards)

VISION AND MISSION OF THE UNIVERSITY

Vision

"To provide quality education to reach the un-reached"

Mission

- To conduct research, teaching and outreach programmes to improve conditions of human living
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

1. PREAMBLE

Taxonomy forms three learning domains: Cognitive (knowledge), affective (attitude) and psychomotor (skill). This classification enables to estimate the learning capabilities of students. Briefly, it is aimed to restructure the curriculum as student-oriented, skill-based, and institution-industry interaction curriculum with the various courses under "Outcome Based Education with Problem Based Courses, Project Based Courses, and Industry Aligned Programmes "having revised Bloom's Taxonomy for evaluating students' skills.

Cognitive Domain

(Lowerlevels:K1: Remembering; K2:Understanding; K3:Applying;Higherlevels:K4: Analyzing; K5: Evaluating; K6: Creating)

Affective Domain

PsychomotorDomain.

All the changes in life in one-way or other involve chemistry. Chemistry is central to the current revolutions inscience. No educatedpersontodaycanunderstandthe modernworldwithout a basic knowledge ofchemistry. The existence of a large number ofchemical factories, mines and related industries necessitates chemistry education.An advanced course in chemistry will be a fascinating experience because it helpsusunderstanding our surroundings. Hence, the Programme M.Sc. (Chemistry) is offered to meet current needs of aspiring youths and also create awareness about the in-depth scientific aspects to the society.

PROGRAMME EDUCATIONAL OUTCOMES (PEO)

In alignment with the Vision and Mission of the University, the following have been defined as the PEO for the graduates.

PEO1: Developing strong positive attitude to learn independently the concepts in the field of study

PEO2: Ensuring confidence among the learners to apply the knowledge and skills gained to solve real life issues

PEO3: Habituating ethical values among the learners to succeed in personal and professional life

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2. FRAMEWORKFORPOSTGRADUATEEDUCATION

3. After the successful completion of **Postgraduate Programme** from the University, the learner should be able

MANONMANIAMSUNDARANARUNIVERSITY,TIRUNELVELI-12 PG - COURSES – AFFILIATED COLLEGES FRAMEWORKFORPOSTGRADUATEEDUCATION	
Programme	**M. ScChemistry**
ProgrammeCode	
Duration	**PG–2YEARS**
Programme Outcomes(POs)	**PO1:ProblemSolvingSkill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.
	PO2:Decision Making Skill Fosteranalyticalandcriticalthinkingabilitiesfordata-baseddecision-making.
	PO3:EthicalValue Abilityto incorporate quality, ethicaland legal value-based perspectives to all organizational activities.
	PO4:Communication Skill Abilitytodevelopcommunication,managerialandinterpersonalskills.
	PO5: IndividualandTeamLeadership Skill Capability to lead themselves and the team to achieve organizational goals.
	PO6:EmployabilitySkill Inculcatecontemporary businesspracticestoenhanceemployability skills in the competitive environment.
	PO7:EntrepreneurialSkill Equipwithskills andcompetenciestobecomeanentrepreneur.

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On successful completion of Postgradyate programme, the student should be able to:

Programme Specific Outcomes (PSOs)	**PSO1–Disciplinary knowledge** Develop knowledge, understanding and expertise in their chosen field of chemical science. Also, exhibit proficiency in performing experiments in the laboratory **PSO2- Analytical & Scientific Reasoning**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. **PSO3-Data interpretation** Understand theoretical concepts of instruments that are commonly used in most chemistry fields as well as interpret and use data generated in instrumental chemical analyses. **PSO4– Contribution on the environment** Develop an understanding of eco-friendly chemical processes and impact of chemistry on health and environment. **PSO5 – Research and Development** DesignandimplementHRsystemsandpracticesgroundedinresearch that comply with employment laws, leading the organization towards growth and development. **PSO6– Self-directed & Lifelong Learning:** Continuously update the knowledge by lifelong learning and contribute to the growth and development of science and technology. **PSO7– Placement andEntrepreneur** Create effectiveentrepreneursbyenhancingtheircriticalthinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. Preparethestudentswhowilldemonstraterespectfulengagementwith others'ideas,behaviors,beliefsandapplydiverseframesofreference to decisions and actions

Each Course has to address a minimum of 4 PSOs

Level of contribution of the Course towards attaining PSOs

0 – No Contribution 1 – Low Level 2 – Medium Level 3 – High Level

COURSE OUTCOMES (CO)

Four Course Outcomes (COs) for each course that can be achieved by the learners on completion of that particular course are as follows:

Considering outcomes related to

i. K1 and K2 level of evaluation in all the Units as CO1

ii. K3 level of evaluation in all the Units as CO2

iii. K4 level of evaluation in all the Units as CO3

iv. K5 and K6 level of evaluation in all the Units as CO4.

All the COs proposed in each of the courses should be mapped with POs based on the relevance Level of Correlation between COs and POs

0 – No Correlation 1 – Low 2 – Medium 3 – High

G. Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grids:

	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	3	2	2	3	3	2	3	3	3	3	3	3	3
CO2	3	3	2	2	2	3	2	3	3	3	1	2	1	3
CO3	2	2	2	2	2	3	2	2	3	3	3	2	2	3
CO4	1	2	1	2	2	3	1	2	2	3	2	2	1	3

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4. ChoiceBasedCreditSystem(CBCS),LearningOutcomesBasedCurriculumFramework(LOCF) Guideline Based Credits and Hours Distribution System

First Year–Semester– I

Part	List of Courses	Credits	No.ofHours
	Core–I	4	5(4L+1T)
	Core–II	4	5 (4L+1T)
	Core–III -Practical	3	5(4P+1T)
	Core-IV - Practical	3	5(4P+1T)
	Elective-I	3	5(4L+1T)
	Elective–II	3	5(4L+1T)
		20	**30**

Semester– II

Part	List of Courses	Credits	No.of Hours
	Core–V	4	5(4L+1T)
	Core–VI	4	5(4L+1T)
	Core–VII -Practical	3	4(3P+1T)
	Core-VIII -Practical	3	4(3P+1T)
	Elective-III	3	4(3L+1T)
	Elective–IV	3	4(3L+1T)
	Skill Enhancement Course-I	2	4
		22	**30**

SecondYear– Semester–III

Part	List of Courses	Credits	No.of Hours
	Core–IX	5	6(5L+1T)
	Core–X	5	6(5L+1T)
	Core–XI - Practical	4	5(4P+1T)
	Core(Industry Module)–XII	5	5(4P+1T)
	Elective–V	3	4(3L+1T)
	Skill Enhancement Course-II	2	4
	Internship/Industrial Activity [Credits]	2	-
		26	**30**

Semester-IV

Part	List of Courses	Credits	No.of Hours
	Core –XIII	5	6(5L+1T)
	Core–XIV	5	6(5L+1T)
	Project with VIVAVOCE	7	10
	Elective –VI(Industry Entrepreneurship)	3	4
	Skill Enhancement Course–III/ Professional Competency Skill	2	4
	Extension Activity	1	-
		23	**30**

Total 91Credits for PG Courses

5. COMPONENTWISECREDITDISTRIBUTION

Credits		Sem I	Sem II	Sem III	Sem IV	Total
PartA		**20**	**20**	**22**	**20**	**82**
PartB	**(i)Discipline–Centric/ Generic Skill**		**2**	**2**	**2**	**6**
	(ii)SummerInternship/ Industrial Training			**2**		**2**
PartC					**1**	**1**
	Total	**20**	**22**	**26**	**23**	**91**

Part A component and Part B (i) will be taken into account for CGPA calculation for the postgraduate programme and the other components Part B and Part C have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the PG degree.

6. LEARNINGANDTEACHINGACTIVITIES

6.1 TopicwiseDeliverymethod

HourCount	Topic	Unit	ModeofDelivery

5.2.WorkLoad

The information below is provided as a guide to assist students in engaging appropriately with the course requirements.

Activity	Quantity	Workloadperiods
Lectures	60	60
Tutorials	15	15
Assignments	5	5
CycleTestor similar	2	4
ModelTest orsimilar	1	3
UniversityExam	1	3
	Total	90periods

7. TUTORIALACTIVITIES

Tutorial Count	Topic

8. LABORATORYACTIVITIES

9. FIELDSTUDYACTIVITIES

10. ASSESSMENTACTIVITIES

9.1. AssessmentPrinciples

Assessmentforthiscourseisbasedonthefollowingprinciples

1. Assessmentmust encourageandreinforce learning.
2. Assessmentmustmeasureachievementofthestatedlearningobjectives.
3. Assessmentmust enablerobust andfair judgmentsaboutstudentperformance.
4. Assessment practice must befair andequitableto studentsandgivethemtheopportunity to demonstrate what they learned.
5. Assessmentmust maintainacademicstandards.

9.2. AssessmentDetails

AssessmentItem	DistributedDueDate	Weightage	Cumulative Weightage
Assignment1	3rdweek	2%	2%
Assignment2	6th Week	2%	4%
CycleTest– I	7th Week	6%	10%
Assignment3	8th Week	2%	12%
Assignment4	11th Week	2%	14%
CycleTest–II	12th Week	6%	20%
Assignment5	14th Week	2%	22%
ModelExam	15th Week	13%	35%
Attendance	Allweeks as perthe AcademicCalendar	5%	40%
UniversityExam	17th Week	60%	100%

11. TEACHINGMETHODOLOGIES

1. Traditional Teaching methods like Chalk and Board, VirtualClass room, LCD projector,SmartClass, Video Conference, Guest Lectures.
2. Asking studentsto formulate aproblemfromatopic covered ina week'stime Assignment, ClassTest, Slip test.
3. Asking students to use state-of-the-art technologies/software to solve problems. Applications: Use of chemdraw, chempaint software
4. Introducingstudentstoapplicationsbeforeteachingthetheory.
5. Training studentstoengage inself-studywithout relying on faculty(forexample – libraryandinternet search, manual and handbook usage, etc.)

   5.1 Library,NetSurfing,Manuals,NPTELCourseMaterialspublishedinthe website

   5.2 Otheruniversitywebsites.

12. FACULTYCOURSEFILESTRUCTURE

CONTENTS

a) AcademicSchedule
b) StudentsNameList
c) TimeTable
d) Syllabus
e) LessonPlan
f) StaffWorkload
g) CourseDesign(content,CourseOutcomes(COs),Deliverymethod,mappingofCOswithProgramme Outcomes (POs), Assessment Pattern in terms of Revised Bloom's Taxonomy)
h) SampleCOAssessmentTools
i) FacultyCourseAssessmentReport(FCAR)
j) CourseEvaluationSheet
k) TeachingMaterials(PPT,OHPetc.)
l) LectureNotes
m) HomeAssignmentQuestions
n) TutorialSheets
o) RemedialClassRecord,ifany
p) ProjectsrelatedtotheCourse

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q) LaboratoryExperimentsrelatedtotheCourses

r) InternalQuestionPaper

s) External QuestionPaper

t) SampleHomeAssignment Answer Sheets

u) Threebest,threemiddlelevelandthreeaverageAnswersheets

v) ResultAnalysis(COwiseandwholeclass)

w) QuestionBankforHigherstudiesPreparation(GATE/Placement)

x) Listofmenteesandtheiracademicachievements

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13. COURSESTRUCTURE

M.Sc. Chemistry

First Year-Semester-I

	Courses	**Credit**	**Hours per Week(L/T/P)**
PartA	CoreCourses4 (CC1,CC2,CC3,CC4)	14	20
	ElectiveCourses2(Generic/DisciplineSpecific)EC1,EC2	6	10
		20	**30**

Semester-II

	Courses	**Credit**	**Hours per Week(L/T/P)**
PartA	CoreCourses4 (CC5,CC6,CC7,CC8)	14	18
	ElectiveCourses2(Generic/DisciplineSpecific)EC3, EC4	6	8
PartB	SkillEnhancementCourse-SEC1(OnefromGroup G)	2	4
		22	**30**

SecondYear– Semester-III

	Courses	**Credit**	**Hours per Week(L/T/P)**
PartA	CoreCourses4 (CC9,CC10,CC11,CC12)	19	22
	ElectiveCourse1(Generic/DisciplineSpecific)EC5	3	4
PartB	SkillEnhancementCourse-SEC2(OnefromGroupG)	2	4
	Internship/IndustrialActivity(CarriedoutinSummerVacation at theendofIyear–30hours)	2	
		26	**30**

Semester-IV

Part	**Courses**	**Credit**	**Hours per Week(L/T/P)**
PartA	CoreCourses 2 (CC13,CC14)	10	12
	ProjectwithViva voce	7	10
	ElectiveCourse1(Industry/Entrepreneurship)EC6	3	4

PartB	Professional Competency Skill Enhancement CourseTrainingforCompetitiveExaminations • Chemistry for NET / UGC - CSIR/SET /TRBCompetitive Examinations (2 hours) • General Studies for UPSC / TNPSC / Other Competitive Examinations (2 hours)	2	4
PartC	Extension Activity(Canbe carriedoutfromSemIItoSemIV)	1	
		23	**30**

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14. CreditDistributionforPGProgrammeinChemistry
M. ScChemistry

Illustration - I

	FirstYear Semester-I	**Credit**	**Hours per week(L/T/P)**
PartA	CC1–OrganicReactionMechanism-I	4	5(4L+1T)
	CC2–StructureandBondinginInorganic Compounds	4	5(4L+1T)
	CC3– OrganicChemistryPractical -I	3	5(4P+1T)
	CC4 – PhysicalChemistryPractical	3	5(4P+1T)
	ElectiveI– EC1(OnefromGroupA) PharmaceuticalChemistry/NanomaterialsandNanotechnology	3	5(4L+1T)
	Elective II–EC2(OnefromGroupB) Electrochemistry/MolecularSpectroscopy	3	5(4L+1T)
	Total	**20**	**30**

	Semester-II	**Credit**	**Hours per week(L/T/P)**
PartA	CC5–Organicreactionmechanism-II	4	5(4L+1T)
	CC6–PhysicalChemistry-I	4	5(4L+1T)
	CC7– Organic ChemistryPractical-II	3	4(3P+1T)
	CC8– InorganicChemistryPractical-I	3	4(3P+1T)
	ElectiveIII–EC3 (OnefromGroupC) MedicinalChemistry/GreenChemistry	3	4(3L+1T)
	Elective-IV-EC4(OnefromGroupD) BioInorganicChemistry/MaterialScience	3	4(3L+1T)
PartB	SkillEnhancement Course-SEC1(OnefromGroupG) Computational Chemistry	2	4
	Total	**22**	**30**

15. CONSOLIDATEDTABLEFORCREDITSDISTRIBUTION

	Categoryof Courses	Numberof Courses	Number of Credits ineach Categoryof Courses	Total Credits	TotalCredits for theProgramme
PARTA	Core	14	57	82	88 (CGPA)
	Project with vivavoce	1	7		
	Elective (Genericand Discipline Centric)	6	18		
PARTB (i)	Skill Enhancement (Term paper and Seminar & Generic/ Discipline - Centric Skill Courses) (Internal Assessment Only)	3	6	6	
PARTB(ii)	Summer Internship	1	2	2	03(Non CGPA)
PARTC	Extension Activity	1	1	1	
					91

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16. TEMPLATEFORSEMESTEREXAMINATION

Code	Category	TitleofthePaper	Marks (Max100)		Duration for UE	Credits
			CIA	UE		
Semester–I						
PartA	Core I	Theory	25	75	3Hrs	4
	Core II	Theory	25	75	3Hrs	4
	Core III	Practical	50	50	3Hrs	3
	CoreIV	Practical	50	50	3Hrs	3
	Elective I	Elective-I (Choose one from Group-A)	25	75	3Hrs	3
	Elective II	Elective-II (Choose one from Group-B)	25	75	3Hrs	3
Semester-II						
PartA	Core V	Theory	25	75	3Hrs	4
	CoreVI	Theory	25	75	3Hrs	4
	Core VII	Practical	50	50	3Hrs	3
	CoreVIII	Practical	50	50	3Hrs	3
	Elective III	Elective-III (Choose one from Group-C)	25	75	3Hrs	3
	Elective IV	Elective-IV (Choose one from Group-D)	25	75	3Hrs	3
PartB	Skill Enhancement Course -SEC 1	(Choose one from Group-G)	Internal Assessment			2

17. ELECTIVECOURSES

Courses are grouped (GroupAto GroupE)so asto include topics fromPure Chemistry(PC), Applied Chemistry (AC) and Industrial Components (IC) like Pharmaceutical Industries, Polymer labs courses for flexibility of choice by the stakeholders / institutions.

SemesterI:ElectiveIandElective II

ElectiveIto bechosen from**Group A**and **ElectiveII**to bechosenfrom**GroupB**

Group A: (PC/AC/IC)

1. PharmaceuticalChemistry
2. NanomaterialsandNanotechnology

GroupB(PC/AC/IC)

1. Electrochemistry
2. MolecularSpectroscopy

SemesterII: ElectiveIII & Elective IV

ElectiveIIItobechosenfrom**GroupC**and**ElectiveIV**tobechosenfrom**GroupD Group C**:**(PC/AC/IC)**

1. MedicinalChemistry
2. GreenChemistry

Group D(PC/AC/IC)

1. BioinorganicChemistry
2. MaterialScience

SemesterIII:ElectiveV

ElectiveVto bechosenfrom**GroupE Group E: (PC/AC/IC)**

1. Pharmacognosyand Phytochemistry
2. BiomoleculesandHeterocycliccompounds

18. SKILLENHANCEMENTCOURSES

Skill Enhancement Courses are chosen to keep in pace with the latest developments in the academic/ industrialfront and provides flexibility ofchoicebythestakeholders/ institutions.

Group G (Skill Enhancement Courses) SEC: (Practical based paper)

- ComputationalChemistry
- 3Dprinting inChemistry
- PreparationofConsumerproducts
- Chemistryineverydaylife

- CosmeticChemistry
- Originlab
- IndustrialChemistry
- ResearchToolsandTechniques

19. TESTINGPATTERN(25+75)

19.1 InternalAssessment

Theory Course: For theory courses, there shall be three tests conducted by the faculty concernedandtheaverageofthebesttwocanbetakenastheContinuousInternalAssessment (CIA)foramaximumof25marks.Thedurationofeachtest shallbeone/oneandahalfhour.

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 fromthetwo Laboratorypart. Theaverageofthe best two can betreated asthe CIA for a maximumof25 marks. The durationofeachtest shallbe one /one and a half hour.

There is no improvement for CIAofboththeoryand laboratory, and, also for UniversityEnd Semester Examination.

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19.2 ExternalAssessment

WrittenExamination:TheoryPaper(Bloom'sTaxonomybased)

QuestionPaperModel

IntendedLearningSkills	**Maximum75Marks** **PassingMinimum:50%** **Duration: Three Hours**
	Part–A(15x1=15Marks) Answer ALL questions **Each Question carries 1 mark**
Memory Recall / Example/ Counter Example / Knowledge abouttheConcepts/Understanding	Three questions from each UNIT
	Question1toQuestion15
	Part–B(5x4=20Marks) Answer **ALL questions** **Each questions carries 4 Marks**
Descriptions/ Application (Problems)	**Either-or-Type** Both parts of each question from the same UNIT
	Question 16 (a) or 16 (b) To **Question 20 (a) or 20 (b)**
	Part-C (5x 8 = 40 Marks) **Either-or-Type** Both parts of each question from the same UNIT **Each question carries 8 Marks**
Analysis/Synthesis/Evaluation	There shall be **FIVE** questions covering all the five units
	Question 21 (a) or 21 (b) To **Question 25 (a) or 25 (b)**

Eachquestionshouldcarrythecourseoutcomeandcognitivelevel. For instance,

1. [CO1:K2] Questionxxxx
2. [CO3:K1] Questionxxxx

20. DIFFERENTTYPESOFCOURSES

(i) CoreCourses

(ii) ElectiveCourses(EDwithintheDepartmentExperts)

(iii) SkillDevelopmentCourses

(iv) Institution-Industry-Interaction(IndustryalignedCourses)

Programmes/course work/ field study/ Modelling the IndustryProblem/ Statistical Analysis/ Commerce-Industryrelated problems / MoU with Industryand the like activities.

21. SYLLABUSFORM.Sc.CHEMISTRY

SEMESTER - I

<table>
<tr><td>Titleofthe Course</td><td colspan="7">ORGANICREACTIONMECHANISM -I</td></tr>
<tr><td>PaperNo.</td><td colspan="7">CoreI– CC1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hoursper 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">Basicconceptsoforganic chemistry</td></tr>
<tr><td>Objectivesof the course</td><td colspan="7">To understand the feasibility and the mechanism of various organic reactions.
Tocomprehendthetechniquesinthedeterminationofreactionmechanisms. To understand the concept of stereochemistry involved in organic compounds.
To correlate and appreciate the differences involved inthe varioustypesof organic reaction mechanisms.
Todesignfeasiblesyntheticroutesforthepreparationoforganic compounds.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I: Methods of Determination of Reaction Mechanism: Reaction intermediates, The transition state, Reaction coordinate diagrams, Thermodynamicandkineticrequirementsofreactions,Hammondpostulate.
Methods of determining mechanism: Kinetic methods of determination: Rate law – Primary and secondary isotope effect. Non-Kinetic methods of determination: Testing and Trapping of intermediates, Isotopic labeling, Cross–over experiment, Product analysis and stereo chemical evidence.
EffectofstructureonreactivityHammettandTaftequations.</td></tr>
<tr><td colspan="7">UNIT-II: Aromatic and Aliphatic Electrophilic Substitution: Aromaticity: Aromaticity in benzenoid, non-benzenoid, heterocyclic compounds and annulenes.
Aromatic electrophilic substitution: Orientation and reactivity of di- and polysubstituted phenol, nitrobenzene and halobenzene. Reactions involving nitrogenelectrophiles: nitration, nitrosationand diazoniumcoupling;</td></tr>
</table>

	AliphaticelectrophilicsubstitutionMechanisms:SE2andSEi,SE1-Mechanismand evidences.
	UNIT-III: **Aromatic and Aliphatic Nucleophilic Substitution:** **Aromaticnucleophilicsubstitution**:Mechanisms -S_NAr, $S_N1$andBenzyne mechanisms-Evidences-Reactivity,Effectofstructure,leavinggroupand attackingnucleophile.Reactions:OxygenandSulphur-nucleophiles,Bucherer and Rosenmund reactions,Von Richter,Sommelet-Hauser and Smiles rearrangements. **Aliphatic Nucleophilic Substitution**: S_N1, ion pair, S_N2 mechanisms and evidences.Aliphaticnucleophilicsubstitutionsatanallyliccarbon,aliphatic trigonal carbon and vinyl carbon. S_N1' S_N2' and S_Ni' mechanism and evidences,-Ambident nucleophiles.
	UNIT-IV: Stereochemistry-I: Introduction to molecular symmetry and chirality – axis, plane, center, alternating axis of symmetry. prochirality, enantiotopic and diastereotopic atoms, groups, faces, axialand planar chirality, chiralitydue to helical shape, methods of determining the configuration. Racemic modifications: Racemization by thermal, anion, cation, reversible formation, epimerization, mutarotation. D, L system, Cram's and Prelog's rules: R, S-notations, proR, proS, side phase and re phase Cahn-Ingold-Prelogrules,absoluteandrelativeconfigurations.Configurationsofallenes, spiranes, biphenyls, cyclooctene, helicene, binaphthyls, ansa and cyclophanic compounds, asymmetric synthesis,destruction.
	UNIT-V: Stereochemistry-II: Curtin-HammettPrinciple.Stabilityoffiveandsix-memberedrings:mono-,di- and

	Polysubstituted cyclohexanes, conformation and reactivity in cyclohexane systems.Fused and bridge drings:bicyclic,polycyclicsystems,decalins and Brett's rule. Optical rotation and optical rotatorydispersion,conformational asymmetry, ORD curves, octant rule, configuration and conformation, Cotton effect, axial haloketone rule and determination of configuration.
Extended Professional Component(is a part of internal component only,Nottobe includedinthe external examination questionpaper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved. (TobediscussedduringtheTutorial hours)
Skillsacquired from this course	Knowledge,Problemsolving,Analyticalability,ProfessionalCompetency, Professional Communication and Transferable skills.
Recommended Text	1. J.MarchandM.Smith,AdvancedOrganicChemistry,5th edition,John-Wiley and Sons.2001. 2. E.S.Gould,MechanismandStructureinOrganicChemistry,Holt, Rinehart and Winston Inc., 1959. 3. P.S.Kalsi,Stereochemistryofcarboncompounds,8th edition,NewAge International Publishers, 2015. 4. P.Y.Bruice, OrganicChemistry,7th edn,Prentice Hall, 2013. 5. J.Clayden,N.Greeves,S.Warren,OrganicCompounds,2nd edition, Oxford University Press, 2014.
Reference Books	1. F.A.Carey andR.J.Sundberg,AdvancedOrganicChemistry Part-A and B, 5th edition, Kluwer Academic / Plenum Publishers, 2007. 2. D.G.Morris, Stereochemistry, RSCTutorialChemistryText1,2001. 3. N.S.Isaacs,PhysicalOrganicChemistry,ELBS,Longman,UK,1987. 4. E.L.Eliel,StereochemistryofCarbonCompounds,Tata-McGrawHill, 2000. 5. I.L.Finar,Organicchemistry,Vol-1&2,6th edition,PearsonEducation Asia,2004.
Websiteand e-learning source	1.https://sites.google.com/site/chemistryebookscollection02/home/organic-chemistry/organic 2. https://www.organic-chemistry.org/
CourseOutcomes(forMappingwithPOsandPSOs) Studentswillbeable **CO1**:To recallthebasicprinciplesoforganicchemistry. **CO2**:Tounderstandtheformationanddetectionofreactionintermediatesoforganic reactions. **CO3**:Topredictthereactionmechanismoforganicreactionsandstereochemistryof organiccompounds.	

CO4:To applytheprinciplesofkineticandnon-kinetic methodsto determinethe mechanism of reactions.
CO5:Todesignandsynthesizeneworganiccompoundsbycorrelatingthestereochemistry of organic compounds.

CO-POMapping(CourseArticulation Matrix)

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

Strong – 3, Medium-2, Low-1

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

Methods of Evaluation		
Internal Evaluation	ContinuousInternalAssessmentTest	25Marks
	Assignments	
	Seminars	
	AttendanceandClass Participation	
External Evaluation	EndSemesterExamination	75Marks
	Total	100Marks
MethodsofAssessment		
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions.	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, short summaryor overview.	

Application (K3)	Suggestidea/conceptwithexamples,suggestformulae,solveproblems, Observe, Explain.
Analyze(K4)	Problem-solving questions, finish a procedure in many steps, Differentiatebetweenvariousideas,Mapknowledge.
Evaluate (K5)	Longeressay/Evaluationessay, Critiqueorjustifywithprosandcons.
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion,Debating orPresentations.

Inorderto avoid pullthe score downofeachPO, it issuggested thatthe usage L-Low (1)to the minimum.
TheS, M,Lisbasedonthecourseoutcome. Themapping isbasedontherevisedBloom's Taxonomy Verbs used to describe your course outcome.

- RememberandUnderstanding –Lowerlevel
- ApplyandAnalyze–MediumLevel
- EvaluateandCreate–Strong Level

MSU

<table>
<tr><td>Titleofthe Course</td><td colspan="8">STRUCTUREANDBONDINGININORGANICCOMPOUNDS</td></tr>
<tr><td>PaperNo.</td><td colspan="8">CoreII–CC2</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td>Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">BasicconceptsofInorganicChemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">Todeterminethestructural propertiesofmaingroupcompoundsand clusters.
Togainfundamentalknowledgeonthestructuralaspectsofioniccrystals.
To understand structures and bonding in inorganic polymers and metal clusters.
Tostudytheeffectofpointdefectsandlinedefects inionic crystals.
Toevaluate thestructuralaspectsofsolids.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I-CHEMICALBONDING
Valence Bond theory: Lewis structure – Conceptsand VBtheoryofH_2molecule - Stereochemistry of hybrid orbitals – Calculation of s and p charactersofequivalenceandnonequivalenceofhybridorbitals-VSEPR theory.
M.O. theory – Linear combination of Atomic orbitals (s – s, s – p, d – p, p – p and d –doverlapping) – σ ,π ,δ and quadruple bond. – M.O. diagrams of hetero nuclear diatomic molecules (CO, NO, HF) and triatomicmolecules(BeH_2,H_2O,CO_2)–Walshdiagrams–Structureand hybridization - Bents rule and apicophilicity.
IonicBond:Latticeenergy-Born-Landeequation,BornHabercycle andKapustinskiiequation.</td></tr>
<tr><td></td><td colspan="8">UNIT-II:Structureofmaingroupcompoundsandclusters:Structure of silicates - applications of Pauling’s rule of electrovalence - isomorphousreplacements in silicates – ortho, meta and pyro silicates – one dimensional, two dimensional and three-dimensional silicates. Structure of silicones, Structural and bonding features of B-N, S-N and P-N compounds; Poly acids – types, examples and structures; Borane cluster: Structural features of closo, nido, arachano and klado; carboranes,heteroandmetalloboranes;Wade’sruletopredictthe tructureofborane cluster; main group clusters–zintl ions.</td></tr>
</table>

	UNIT-III: Solid state chemistry – I: Ionic crystals: Packing of ions in simple, hexagonal and cubic close packing, voids in crystal lattice, Radius ratio, Crystalsystems and Bravais lattices, Symmetryoperations in crystals, glide planes and screw axis; point group and space group. X-raydiffractiontechnique:Bragg'slaw,Powderdiffractionmethod–PrincipleandInstrumentation.
	UNIT-IV: Solid state chemistry – II: Structural features ofthe crystal systems: Rock salt, zinc blende & wurtzite, fluorite and anti-fluorite, rutile and anatase, cadmium iodide and nickelarsenide;Spinels -normal and inverse types and perovskite structures. Crystal Growth methods: Frommeltandsolution(hydrothermal,sol-gelmethods)–principlesand examples.
	UNIT-V:Bandtheory anddefectsinsolids Band theory – features and its application of conductors, insulators and semiconductors, Intrinsic and extrinsic semiconductors; Defects in crystals – point defects (Schottky, Frenkel, metal excess and metal deficient) and their effect on the electrical and optical property; Linear defectsanditseffectsduetodislocationsandcolourcenters.
Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved (TobediscussedduringtheTutorial hours)
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. ARWest,SolidstateChemistryand itsapplications,2ndEdition (Students Edition), John Wiley & Sons Ltd., 2014. 2. A K Bhagi and G R Chatwal, A textbook of inorganic polymers, Himalaya Publishing House, 2001. 3. L Smart, E Moore, Solid State Chemistry – An Introduction,4thEdition, CRC Press, 2012. 4. K. F. Purcelland J. C. Kotz, Inorganic Chemistry; W.B. Saunders company: Philadelphia, 1977. 5. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry; 4th ed.; Harper and Row: NewYork, 1983.

ReferenceBooks	1. D.E.Douglas,D.H.McDanielandJ.J. Alexander,Conceptsand Models in Inorganic Chemistry, 3rd Ed, 1994. 2. RJDTilley, Understanding Solids - The Science ofMaterials, 2nd edition, Wiley Publication, 2013. 3. C N R Rao and J Gopalakrishnan, New Directions in Solid State Chemistry, 2nd Edition, Cambridge University Press, 199. 4. T.Moeller,InorganicChemistry,AModernIntroduction;John Wiley: New York, 1982. 5. D.F.Shriver,P.W.AtkinsandC.H.Langford;Inorganic Chemistry;3rded.;OxfordUniversityPress:London,2001.
Websiteand e-learningsource	https://ocw.mit.edu/courses/3-091-introduction-to-solid-state-chemistry-fall-2018/video_galleries/lecture-videos/

CourseLearningOutcomes(forMappingwithPOsandPSOs)

Studentswillbeable

CO1:Topredictthegeometryofmaingroupcompoundsand clusters.

CO2:Toexplainaboutthepackingofionsincrystalsandapplytheradiusratioruleto predict the coordination number of cations.

CO3:Tounderstandthevarious typesof ioniccrystal systemsandanalyzetheirstructural features.

CO4:Toexplainthe crystalgrowthmethods.

CO5:To understand thevarioustypesofdefectsincrystals.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

3–Strong,2 –Medium, 1 -Low

<table>
<tr><td>Titleofthe Course</td><td colspan="7">ORGANICCHEMISTRYPRACTICAL-I</td></tr>
<tr><td>PaperNo.</td><td colspan="7">CoreIII-CC3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>1</td><td colspan="3">4</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basicconceptsoforganicchemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="7">Tounderstandtheconceptofseparation,qualitativeanalysisand preparation of organic compounds.
Todevelopanalyticalskillinthehandlingofchemicalreagentsfor separation of binary and ternary organic mixtures.
Toanalyzetheseparatedorganiccomponentssystematicallyand derivativethemsuitably.</td></tr>
<tr><td>Course Outline</td><td colspan="7">A. QualitativeanalysisofOrganicmixture(atleastsixtwocomponent mixtures):
• Separationoforganicmixtures
• Elementalanalysis
• Functionalgroup(s)identification
• Preparationofderivatives
• Physicalpropertiesdetermination(meltingpointandboiling point) for both components and their derivatives.
Analysis may be performed in micro (or) macro scale depending upon the conditions of the laboratory.
B. ForClasswork:
Threecomponentmixtures(Separation)</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination questionpaper)</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved
(TobediscussedduringtheTutorial hours)</td></tr>
<tr><td>Skillsacquired fromthiscourse</td><td colspan="7">Knowledge, Problem solving, Analytical ability, Professional Competency,ProfessionalCommunicationandTransferableskills.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">1. A.I.Vogel,ElementaryPracticalOrganic Chemistry:SmallScale Preparations,QualitativeOrganic Analysis, Quantitative Organic Analysis, Pearson Education, 2011.
2. K.Bansal Raj, Laboratory Manual of Organic Chemistry, New AgeInternational, 2009.
3. V.Venkateswaran,R.VeeraswamyandA.R.Kulandaivelu,Basic Principles of Practical Chemistry, Sultan Chand & Sons, 2004.
4. V.K. Ahluwalia, and R. Aggarwal, Comprehensive Practical Organic Chemistry, UniversitiesPress, 2004</td></tr>
</table>

ReferenceBooks	1. R.G. Engel, D.L. Pavia, G.M. Lampman and G.S. Kriz, A Microscale approach to Organic Laboratory, 5th edition, Paperback – International Edition, 2012. 2. P.B. Cranwell, L.M. Harwood, and C. J. Moody, Experimental Organic Chemistry, 3rd edn,Wiley-Blackwell**,** 2017. 3. J. Leonard,B.Lygo and G. Procter, Advanced PracticalOrganic Chemistry, 3rd edn, CRC Press, 2013.
Websiteand e-learningsource	https://ocw.mit.edu/courses/3-091-introduction-to-solid-state-chemistry-fall-2018/video_galleries/lecture-videos/

CourseLearningOutcomes(forMappingwithPOsandPSOs)

Studentswillbeable:
CO1: To explain the basic separation procedures of organic mixtures.
CO2:Toselect theseparationmethodstoseparatetheorganicmixtures. **CO3**:
To classify the functional groups using systematic procedure.
CO4:To determinethe physicalpropertiesoforganic compounds.
CO5:Toanalyzetheseparatedorganiccomponentssystematicallyandderivativethem suitably.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium, 1 –Low

<table>
<tr><td>TitleoftheCourse</td><td colspan="7">PHYSICALCHEMISTRYPRACTICAL</td></tr>
<tr><td>PaperNo.</td><td colspan="7">CoreIV-CC4</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>1</td><td colspan="3">4</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basicknowledgeofphysicalchemistry</td></tr>
<tr><td>Objectivesof the course</td><td colspan="7">Tounderstandtheprincipleofconductivityexperimentsthroughconductometric titrations.
Toevaluatetheorderofthereaction,temperaturecoefficientand activation energyofthe reaction by following pseudo first order kinetics.
Toconstructthephasediagramoftwocomponentsystemforming congruent melting solid and find its eutectic temperatures and compositions.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I: Conductivity Experiments
1. Determinationofequivalent conductanceofastrongelectrolyte&the verification of DHO equation.
2. VerificationofOstwald’sDilutionLaw &DeterminationofpKaofa weak acid.
3. VerificationofKohlrausch’sLawforweak electrolytes.
4. Determinationoftheequivalent conductanceofaweakacidat different concentrations and verifying Ostwald dilution law.
5. Calculationofthedissociationconstantoftheacid. Determinationof the equivalent conductance of a strong electrolyte at different concentrationsandexaminingthevalidityoftheOnsager’stheoryas limiting law at high dilutions.
6. Conductometrictitrationofa mixtureofHClandCH₃COOHVs NaOH.
7. Conductometric titrationofNH₄ClVs NaOH.
8. ConductometrictitrationofCH₃COONaVsHCl.</td></tr>
<tr><td></td><td colspan="7">UNIT-II: Kinetics
1. Studythekineticsofacidhydrolysisofanester;determinethe temperaturecoefficientandalsotheactivationenergyofthereaction.
2. Studythe kinetics ofthe reaction betweenacetone and iodine inacidic medium by half-life method and determine the order with respect to iodineand acetone.</td></tr>
<tr><td></td><td colspan="7">UNIT-III:Phasediagram
Construction of phase diagram for a simple binary system
1. Naphthalene-phenanthrene
2. Benzophenone-diphenylamine.</td></tr>
<tr><td>Extended Professional Component(isa partofinternal</td><td colspan="7">Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothersto be solved
(TobediscussedduringtheTutorial hours)</td></tr>
</table>

componentonly, Not to be included in the external examination questionpaper)	
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. B.ViswanathanandP.S.Raghavan,PracticalPhysicalChemistry, Viva Books, New Delhi, 2009. 2. Sundaram,Krishnan,Raghavan,PracticalChemistry(PartII),S. Viswanathan Co. Pvt., 1996. 3. V.D. Athawale and Parul Mathur, Experimental Physical Chemistry, New Age International (P) Ltd., New Delhi, 2008. 4. E.G.Lewers,ComputationalChemistry:IntroductiontotheTheory andApplicationsofMolecularandQuantumMechanics,2nd Ed., Springer, New York, 2011.
Reference Books	1. J.B.Yadav,AdvancedPractical Physical Chemistry,Goel Publishing House, 2001. 2. G.W.Garland,J.W.Nibler,D.P.Shoemaker,Experimentsin Physical Chemistry, 8th edition, McGraw Hill, 2009. 3. J.N.GurthuandR.Kapoor,AdvancedExperimentalChemistry,S. Chand and Co., 1987. 4. ShailendraKSinha,PhysicalChemistry:AlaboratoryManual,Narosa Publishing House Pvt, Ltd., New Delhi, 2014. 5. F.Jensen,IntroductiontoComputational Chemistry,3rd Ed.,Wiley-Blackwell.
Websiteand e-learning source	https://web.iitd.ac.in/~nkurur/2015-16/Isem/cmp511/lab_handout_new.pdf
CourseLearningOutcomes(forMappingwithPOsandPSOs) Studentswillbeable: CO1:Torecalltheprinciplesassociated with variousphysicalchemistryexperiments. CO2:Toexplaintheprinciplesofconductometrictitrationsandestimatethestrengthof solutions. CO3:Toobserveandrecord systematicallythereadingsinalltheexperiments. CO4:Tocalculateandprocesstheexperimentallymeasuredvaluesandcomparewith graphical data. CO5: To interpret the experimental data scientifically to improve students' efficiency for societal developments.	

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium, 1 –Low

LevelofCorrelationbetweenPSO'sand 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
WeightedpercentageofCourse ContributiontoPos	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium, 1 –Low

MSU

<table>
<tr><td>Titleofthe Course</td><td colspan="8">PHARMACEUTICALCHEMISTRY</td></tr>
<tr><td>PaperNo.</td><td colspan="8">ElectiveI–EC1</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">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hoursperweek</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">Basicknowledgeondrugsand doses</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">Tounderstandtheadvancedconceptsofpharmaceuticalchemistry. To recall the principle and biological functions of various drugs.
Totrainthestudentstoknowtheimportanceaswelltheconsequencesof various drugs.
Tofamiliarizeonthedrug dosageanditsstructuralactivities.</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-Dielectricconstantexplanation&determination.Rheology of pharmaceutical systems: Introduction, Definition, Applications, concept of viscosity, Newton’s law of flow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity. Newtonian system, non-Newtonian system- Plastic flow, Pseudoplastic flow, Dilatant flow. Viscositymeasurements-selectionofviscometerforNewtonianand non-Newtoniansystem.</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 researchand sterilization. Physico Chemical Properties anddrugaction.Physicochemicalpropertiesofdrugs(a)Partition coefficient,(b)solubility(c)surfaceactivity,(d)degreeofionization.</td></tr>
<tr><td colspan="8">UNIT-III:Drugdosageandproductdevelopment:Introductionto Drug Dosage Forms & Drug Delivery system – Definition of Common terms.DrugRegulationandcontrol,pharmacopoeiasformularies,</td></tr>
</table>

	sourcesofdrug,drugnomenclature,routesofadministrationofdrug products,needfor adosageform,classificationofdosageforms.
	UNIT-IV:Developmentofnewdrugs: Introduction,procedure followedindrugdesign,theresearchforleadcompounds,molecular modificationofleadcompounds.Structure-ActivityRelationship(SAR): Factorseffectingbioactivity,resonance,inductiveeffect,isosterism, bioisosterism,spatialconsiderations,biologicalpropertiesofsimple functionalgroups,theoriesofdrugactivity,occupancytheory,rate theory,induced-fittheory.Quantitativestructure activityrelationship (QSAR):DevelopmentofQSAR,drugreceptorinteractions,the additivity of group contributions, physico-chemical parameters, lipophilicityparameters,electronicparameter,ionizationconstants,steric parameters,chelationparameters,redoxpotential,indicator-variables.
	UNIT-V:ComputersinPharmaceuticalChemistry: Needof computers for chemistry. Computers for Analytical Chemists-MolecularDocking–Selectionofbindingprotein–RCSB–Druglikenessoftheligand–ADMETproperties–Detectionusing onlineservers–AutoDockVina–MethodsandResultanalysis–VisualizationoftheLigand-Protein interaction.
Extended Professional Component(isa partofinternal componentonly, Nottobe included intheexternal examination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscompetitive examinationsUPSC/TRB/NET/ UGC-CSIR/ GATE/TNPSCothers tobesolved (TobediscussedduringtheTutorial hours)
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. PhysicalChemistry-BahlandTuli. 2. TextBookofPhysicalPharmaceutics,IIndedition,Vallabh Prakashan-. C.V.S. Subramanyam. 3. MedicinalChemistry(OrganicPharmaceuticalChemistry),G.R Chatwal, Himalaya Publishing house. 4. InstrumentalmethodofAnalysis:HubertH,Willard,7thedition. 5. TextbookofPharmaceuticalChemistryby, JayshreeGhosh,S. Chand & company Ltd. Pharmaceutical Chemistry by Dr. S. Lakshmi, Sultanchand&Sons.
ReferenceBooks	1. Computersinchemistry,K.V.Raman,TataMc.Graw-Hill, 1993.

	2. Computers for Chemists, S.K Pundir, Anshu bansal, A pragateprakashan., 2 nd edition, New age international (P) limited, New Delhi. 3. PhysicalPharmacyandPharmaceuticalSciencesbyMartins,Patrick J.Sinko,Lippincott.WilliamandWilkins. 4. Cooper and Gunn's Tutorial Pharmacy ,6th edition by S.J. Carter, CBS Publisher Ltd. 5. Ansels pharmaceuticalDosage forms and Drug DeliverySystemby Allen Popvich and Ansel, Indian edition-B.I. Publication Pvt. Ltd.
Websiteand e-learningsource	https://www.ncbi.nlm.nih.gov/books/NBK482447/https://training.seer.cancer.gov/treatment/chemotherapy/types.html

CourseLearningOutcomes(forMappingwithPOsandPSOs)
Studentswillbeable:

CO1:Toidentifythesuitabledrugsforvarious diseases.
CO2: To apply the principles of various drug action and drug design.
CO3: To acquire the knowledge onproduct development based onSAR.
CO4:Toapplytheknowledgeonapplicationsofcomputersinchemistry.
CO5:Tosynthesize newdrugsafter understandingtheconceptsSAR.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelOfCorrelationBetweenPSO'sAndCO's

CO/PSO	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
WeightedpercentageofCourse Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

<table>
<tr><td>Titleofthe Course</td><td colspan="8">NANOMATERIALSANDNANO TECHNOLOGY</td></tr>
<tr><td>PaperNo.</td><td colspan="8">ElectiveI –EC1</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td>Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basicknowledgeofcrystallographyandmaterialscience</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">Tounderstandtheconceptofnanomaterialsandnanotechnology.
To understand the various types of nano materials and their properties.
Tounderstandtheapplicationsofsyntheticallyimportantnanomaterials. To correlatethe characteristicsofvarious nano materialssynthesized by new technologies.
Todesignsyntheticroutesforsyntheticallyusednewnanomaterials.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT-I: Introduction of nanomaterials and nanotechnologies: Introduction-roleofsize,classification-0D,1D,2D,3D.consolidationof Nano powders. Features of nanostructures, Background of nanostructures. Techniques ofsynthesis of nanomaterials- Bottom–Up, Top–Down,Toolsofthenanoscience.Applicationsofnanomaterialsand technologies.</td></tr>
<tr><td></td><td colspan="8">UNIT-II: Synthetic Methods: Bonding and structure of the nanomaterials, Predicting the Type of Bonding in a Substance crystal structure. Metallic nanoparticles, Surfaces of Materials, Nanoparticle SizeandProperties.Synthesis-Physicalandchemicalmethods-inertgas condensation, arc discharge, laser ablation, sol-gel, solvothermal and hydrothermal-CVD-types,metalloorganic,plasmaenhanced,andlow-pressureCVD.Microwaveassistedandelectrochemicalsynthesis.</td></tr>
<tr><td></td><td colspan="8">UNIT-III: Mechanical Properties of Nanomaterials: Mechanical properties of materials, theories relevant to mechanical properties. Techniques to study mechanical properties of nanomaterials, adhesion and friction, thermal properties of nanomaterials
Nanoparticles:goldandsilver,metaloxides:silica,ironoxideand alumina- synthesisandproperties.</td></tr>
<tr><td></td><td colspan="8">UNIT-IV: Electrical Properties of Nanomaterials: Electrical properties, Conductivity and Resistivity, Classification of Materials basedonConductivity,magneticproperties,electronicpropertiesof materials.Classificationofmagneticphenomena.Semiconductor</td></tr>
</table>

	materials – classification-Ge, Si, GaAs, SiC, GaN, GaP, CdS,PbS. Identificationofmaterials as p and n –type semiconductor-Halleffect - quantumand anomalous, Hallvoltage- interpretationofcharge carrier density.Applicationsofsemiconductors: p-njunctionastransistorsand rectifiers,photovoltaicandphotogalvaniccell.
	UNIT-V:NanoComposites: Nanothinfilms,nanocomposites.Application of nanoparticles in different fields. Core-shell nanoparticles - types, synthesis, and properties. Nanocomposites - metal- ceramic- and polymer-matrix composites-applications. Characterization–SEM,TEMandAFM-principle,instrumentationand applications.
Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination questionpaper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved (TobediscussedduringtheTutorial hours)
Skills acquired fromthiscourse	Knowledge, Problem solving, Analytical ability, Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. S.MohanandV.Arjunan,PrinciplesofMaterialsScience,MJP Publishers, 2016. 2. Arumugam,MaterialsScience,AnuradhaPublications,2007. 3. Giacavazzoet.al.,FundamentalsofCrystallography,International Union of Crystallography. Oxford Science Publications, 2010 4. Woolfson,AnIntroductiontoCrystallography,Cambridge University Press, 2012. 5. JamesF.ShackelfordandMadanapalliK.Muralidhara,Introduction to Materials Science for Engineers. 6th ed., PEARSON Press, 2007.
ReferenceBooks	1. S.Mohanand V.Arjunan,PrinciplesofMaterialsScience,MJP Publishers, 2016. 2. Arumugam,MaterialsScience,AnuradhaPublications,2007. 3. Giacavazzoet.al.,Fundamentalsof 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.

Websiteand e-learningsource	1. http://xrayweb.chem.ou.edu/notes/symmetry.html. 2. http://www.uptti.ac.in/classroom-content/data/unit%20cell.pdf.

CourseLearningOutcomes(forMappingwithPOsandPSOs)

Studentswillbeable:
CO1:Toexplainmethodsoffabricatingnanostructures.
CO2:Torelatetheuniquepropertiesofnanomaterialstoreducedimensionalityofthematerial.
CO3:Todescribetools for propertiesofnanostructures.
CO4:To discussapplicationsofnanomaterials.
CO5:To understand thehealthandsafetyrelatedtonanomaterial.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

<table>
<tr><td>Titleofthe Course</td><td colspan="7">ELECTROCHEMISTRY</td></tr>
<tr><td>PaperNo.</td><td colspan="7">ElectiveII-EC2</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">3</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 hoursperweek</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">Basicknowledgeofelectrochemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="7">Tounderstandthebehaviorofelectrolytesintermsofconductance,ionic atmosphere, interactions.
Tofamiliarizethestructureoftheelectrical doublelayerofdifferent models.
Tocompareelectrodesbetweencurrentdensityandoverpotential. To discuss the mechanism of electrochemical reactions.
Tohighlightthedifferenttypesofovervoltagesanditsapplicationsin electroanalyticaltechniques.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I:Ionics: Arrheniustheory-limitations, Van’t Hofffactorand its relation to colligative properties. Deviation from ideal behavior. Ionic activity, mean ionic activityand mean ionic activitycoefficient-concept of ionic strength, Debye Huckel theory of strong electrolytes, activity coefficientofstrongelectrolytesDeterminationofactivitycoefficiention -solvent andion-ioninteractions.DerivationofDebye-Huckellimiting law at appreciable concentration of electrolytes modifications and applications. Electrolytic conduction-Debye-Huckel Onsager treatment ofstrongelectrolyte-qualitativeandquantitativeverificationand limitations.</td></tr>
<tr><td colspan="7">UNIT-II: Electrode-electrolyte interface: Interfacial phenomena - Evidences for electrical double layer, polarizable and non-polarizable interfaces, Electrocapillary phenomena - Lippmann equation electro capillary curves. Electro-kinetic phenomena electro-osmosis, electrophoresis, streaming and sedimentation potentials, colloidal and poly electrolytes. Structure of double layer: Helmholtz -Perrin, Guoy-ChapmanandSternmodelsofelectricaldoublelayer.Zetapotentialand potentialatzero charge.Applicationsand limitations.</td></tr>
<tr><td colspan="7">UNIT-III:ElectrodicsofElementaryElectrodeReactions:Behavior ofelectrodes: Standard electrodesand electrodesat equilibrium. Anodic andCathodiccurrents,conditionforthedischargeofions.Nernst</td></tr>
</table>

	equation, polarizable and non-polarizable electrodes. Model of three electrodesystem,overpotential.Rateofelectrochemicalreactions:Rates of simple elementary reactions. Butler-Volmer equation and Tafel equation-significance of exchange current density, net current density andsymmetryfactor.Lowandhighfieldapproximations.symmetry factorandtransfercoefficientTafelequationsandTafelplots.
	UNIT-IV: Electrodics of Multistep Multi Electron System: Rates of multi-step electrode reactions. Rate determining step, electrode polarization and depolarization. Transfer coefficients, its significance and determination, Stoichiometric number. Reduction of I^{3-}, Fe^{2+} and dissolutionofFe to Fe^{2+}. Overvoltage - Chemical and electro chemical, Phase,activationandconcentrationoverpotentials.Evolutionofoxygen andhydrogenatdifferentpH.PourbiaxandEvan's diagrams.
	UNIT-V: Concentration Polarization, Batteries and Fuel cells: Modes of Transport of electro active species - Diffusion, migration and hydrodynamic modes. Role of supporting electrolytes. Polarography-principle and applications. Cyclic voltammetry- anodic and cathodic stripping voltammetryand differentialpulse voltammetry.Sodiumand lithium-ion batteries and redox flow batteries. Energy production systems: Fuel Cells: classification,alkalinefuelcells,phosphoricacidfuelcells,high temperaturefuelcells.
Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination questionpaper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved (TobediscussedduringtheTutorial hours)
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. D.R.Crow,Principlesandapplicationsofelectrochemistry, 4thedition, Chapman & Hall/CRC, 2014. 2. J.RajaramandJ.C.Kuriakose,KineticsandMechanismofchemical transformations Macmillan India Ltd., New Delhi, 2011. 3. S.Glasstone,Electrochemistry,AffiliatedEast-WestPress,Pvt., Ltd., New Delhi, 2008.

	4. B.Viswanathan,S.Sundaram,R.Venkataraman,K.Rengarajanand P.S.Raghavan,Electrochemistry-Principlesandapplications,S. Viswanathan Printers, Chennai,2007. 5. JosephWang,AnalyticalElectrochemistry,2nd edition,Wiley,2004.
ReferenceBooks	1. J.O.M.BockrisandA.K.N.Reddy,ModernElectrochemistry,vol.1 and 2B, Springer, Plenum Press, New York, 2008. 2. J.O.M.Bockris,A.K.N. Reddy and M.G.AldecoMorden Electro chemistry, vol. 2A, Springer, Plenum Press, New York, 2008. 3. PhilipH.Rieger,Electrochemistry,2nd edition,Springer,NewYork, 2010. 4. L.I.Antropov,Theoreticalelectrochemistry,MirPublishers, 1977. 5. K.L.Kapoor,ATextbookofPhysicalchemistry,volume-3, Macmillan, 2001.
Websiteand e-learningsource	1.https://www.pdfdrive.com/modern-electrochemistry-e34333229.

CourseLearningOutcomes(forMappingwithPOsandPSOs)

Studentswillbeable:

CO1: To understand the behaviour of electrolytesin solution and compare the structures of electrical double layer of different models.

CO2:TopredictthekineticsofelectrodereactionsapplyingButler-VolmerandTafel equations

CO3:To studythemechanismofmulti-step electrodereactions.

CO4:Todiscussthetheoriesofelectrolytes,electricaldoublelayer,electrodicsandactivity coefficient of electrolytes

CO5:To haveknowledgeonstoragedevicesand electrochemicalreaction mechanism.

MSU

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

MSU

<table>
<tr><td>Titleofthe Course</td><td colspan="8">MOLECULAR SPECTROSCOPY</td></tr>
<tr><td>PaperNo.</td><td colspan="8">ElectiveII–EC2</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">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hoursperweek</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">Basicknowledgeofspectroscopy</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">To understand the influence of rotation and vibrations on the spectra of the polyatomic molecules.
To study the principle of Raman spectroscopy, ESR spectroscopy and fragmentation patterns in Mass spectroscopy.
TohighlightthesignificanceofFranck-Condonprincipleto interpretthe selection rule, intensity and types of electronic transitions.
To interpretthe first and secondorderNMRspectra intermsofsplitting and coupling patterns using correlation techniques such as COSY, HETCOR, NOESY.
Tocarryoutthestructuralelucidationofmoleculesusingdifferent spectraltechniques.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">UNIT-I: Rotational and Raman Spectroscopy: Rotational spectra of diatomic. Intensities of rotational spectral lines, effect of isotopic substitution. Non-rigid rotators. Classical theory of the Raman effect, polarizability as a tensor, polarizability ellipsoids, quantum theory of the Raman effect, Pure rotational Raman spectra of linear and asymmetric top molecules, Stokes and anti-Stokes lines. Vibrational Raman spectra, Raman activity of vibrations, rule of mutual exclusion, rotational fine structure-Q and S branches.</td></tr>
<tr><td colspan="8">UNIT-II: Vibrational Spectroscopy: Vibrations of molecules, harmonic and anharmonic oscillators- Vibrational energy expression, energy level diagram, selection rules, expression for the energies of spectral lines, f undamental absorptions, overtones, hot bands, effect of isotopic substitution. Diatomic vibrating rotor, Vibrational-rotational spectra of diatomic molecules, P, R branches, breakdown of the Born-Oppenheimer approximation.</td></tr>
</table>

	UNIT-III: Electronic spectroscopy: Electronic Spectroscopy: Electronic spectroscopy of diatomic molecules, Frank-Condon principle, dissociation and predissociation spectra. Types of electronic transitions and their selection rules. Photoelectron Spectroscopy: Basic principles, photoelectron spectra of simple molecules, X-ray photoelectron spectroscopy (XPS). Lasers: Laser action, population inversion, properties of laser radiation, examples of simple laser systems [Ruby and CO_2 laser only]
	UNIT-IV: NMR and Mass Spectrometry: **NMR Spectrometry:** Chemical shift, Factors influencing chemical shifts: Mechanism of shielding and deshielding. Spin systems: First order and second order coupling of AB systems, Spin-spin interactions: Homo nuclear coupling interactions-AX, AX_2 &AB types. Vicinal, germinal and long – range coupling - spin decoupling. Nuclear Overhauser effect (NOE),Factors influencing coupling constants and Relative intensities.^{13}C NMR and structural analysis of DEPT spectrum using simple examples. **MassSpectrometry:** Ionization techniques-Electron ionization(EI), chemical ionization(CI), desorption ionization (FAB/MALDI), electro spray ionization (ESI),isotope abundance, molecular ion, Nitrogen rule and McLafferty Rearrangement, fragmentation processes of organic molecules, deduction of structure through mass spectral fragmentation, high resolution. Effect of isotopes on the appearance of mass spectrum.
	UNIT-V: ESR and Mossbauer Spectroscopy: **ESR spectroscopy:** Characteristic features of ESR spectra, line shapes and line widths; ESR spectrometer- instrumentation. The g value and the hyperfine coupling parameter (A), origin of hyperfine interaction. Interpretation of ESR spectra of organic radicals. Spin orbit coupling, significance of g-tensors, zero field splitting and Kramer's degeneracy. Application of Co(II), Cr(III) and Cu(II) metal complexes. **Mossbauer spectroscopy:** Principle of Mossbauer spectroscopy: Doppler shift, recoil energy, Isomer shift, quadrupole splitting, magnetic interactions. Applications: Mossbauer spectra of the following molecules - $FeSO_4$, $FeCl_3$. Prussian blue, $K_4[Fe(CN)_6]$, $K_3[Fe(CN)_6]$, $SnCl_2$ and $SnCl_4$..

Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination questionpaper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved (TobediscussedduringtheTutorial hours)
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. C. N. Banwell and E. M. McCash, *Fundamentals of Molecular Spectroscopy*, 4th Ed., Tata McGraw Hill, New Delhi, 2000. 2. R. M. Silverstein and F. X. Webster, *Spectroscopic Identification of Organic Compounds*, 6th Ed., John Wiley & Sons, New York, 2003. 3. W. Kemp, *Applications of Spectroscopy*, English Language Book Society, 1987. 4. D. H.WilliamsandI.Fleming, *SpectroscopicMethodsin Organic Chemistry*, 4th Ed., Tata McGraw-Hill Publishing Company, New Delhi, 1988. 5. R. S. Drago, *Physical Methods in Chemistry*; Saunders: Philadelphia, 1992.
ReferenceBooks	1. P.W. Atkins and J. de Paula, *Physical Chemistry*, 7th Ed., Oxford University Press, Oxford, 2002. 2. I. N. Levine, *Molecular Spectroscopy*, John Wiley & Sons, New York, 1974. 3. A. Rahman, *Nuclear Magnetic Resonance-Basic Principles*, Springer-Verlag, New York,1986. 4. K. Nakamoto, *Infrared and Raman Spectra of Inorganic and coordination Compounds*, PartB: 5th ed., John Wiley& Sons Inc., New York, 1997. 5. J.A.Weil,J.R.BoltonandJ.E.Wertz,*ElectronParamagnetic Resonance*;WileyInterscience,1994.
Websiteand e-learningsource	1. https://onlinecourses.nptel.ac.in/noc20_cy08/preview 2. https://www.digimat.in/nptel/courses/video/104106122/L14.html
CourseLearningOutcomes(forMappingwithPOsandPSOs)	

Studentswillbe able:
CO1:TounderstandtheimportanceofrotationalandRamanspectroscopy.
CO2:Toapplythevibrationalspectroscopictechniquestodiatomicandpolyatomicmolecules.
CO3: To evaluate different electronic spectra of simple molecules using electronic spectroscopy.
CO4:TooutlinetheNMR, ^{13}CNMR, 2DNMR–COSY, NOESY,Introductionto ^{31}P,^{19}F NMR and ESR spectroscopic techniques.
CO5:Todeveloptheknowledgeonprinciple, instrumentationandstructuralelucidationof simplemoleculesusingMassSpectrometry,EPRandMossbauerSpectroscopytechniques.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand 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
Weightedpercentageof Course ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

SEMESTER-II

<table>
<tr><td>Titleofthe Course</td><td colspan="7">ORGANICREACTIONMECHANISM-II</td></tr>
<tr><td>PaperNo.</td><td colspan="7">CoreV– CC5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td colspan="2">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basicknowledgeoforganic chemistry</td></tr>
<tr><td>Objectivesof the course</td><td colspan="7">Tounderstandthemechanisminvolvedinvarioustypesoforganicreactions with evidences.
Tounderstandtheapplicationsofsyntheticallyimportantreagents.
Todesignsyntheticroutesforsyntheticallyusedorganicreactions.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I: Elimination and Free Radical Reactions: Mechanisms: E2, E1, andE1cBmechanisms.Syn-andanti-eliminations.Orientationofthedouble bond:HoffmannandSaytzeffrules.Reactivity:Effectofsubstrate,attacking bases,leavinggroupandmedium.Stereochemistryofeliminationsinacyclic and cyclic systems, pyrolytic elimination.
Long lived and short-lived radicals – Production ofradicals bythermaland photochemical reactions, Detection and stability of radicals, characteristics of free radicals, Reactions of radicals: polymerization, addition, halogenations, aromatic substitutions, rearrangements. Reactivity: Reactivityonaliphatic,aromatic substrates,reactivity in the attacking radical,effect of solvent.</td></tr>
<tr><td colspan="7">UNIT-II: Oxidation and Reduction Reactions: Mechanisms: Direct electrontransfer,hydridetransfer,hydrogentransfer,displacement,addition-elimination, oxidative and reductive coupling reactions.
Mechanism of oxidation reactions: Dehydrogenation by quinones, seleniumdioxides, ferricyanide, mercuric acetate,lead tetraacetate,osmium tetroxide, Reactions involving cleavage of C-C bonds - cleavage of double bonds, oxidative decarboxylation, allylic oxidation, oxidation by chromium trioxide-pyridine,DMSO-Oxalylchloride(Swernoxidation)and,dimethyl sulphoxide- dicyclohexyl carbodiimide (DMSO-DCCD).
Mechanism of reduction reactions:Wolff-Kishner,Clemmenson, Rosenmund,reductionwithTrialkylandtriphenyltinhydrides,</td></tr>
</table>

	Homogeneoushydrogenation,,MPVand Bouveault-Blancreduction.
	UNIT-III:Rearrangements: **Rearrangements to electron deficient carbon:** Pinacol-pinacolone and semi-pinacolone rearrangements - applications and stereochemistry, Wagner-Meerwein, Demjanov, Dienone-phenol, Benzilic acid and Wolff rearrangements. **Rearrangements to electron deficient nitrogen:** Hofmann, Curtius, Schmidt, Lossen, Beckmann and abnormal Beckmann rearrangements. **Rearrangements to electron deficient oxygen:** Baeyer-Villiger oxidation and Dakin rearrangements. **Rearrangements to electron rich atom:** Favorskii, , Stevens,[1,2]-Wittigand[2,3]-Wittigrearrangements.FriesandPhotoFries rearrangement. **Intramolecularrearrangements:**Claisen,and Benzidinerearrangements.
	UNIT-IV:AdditiontoCarbonMultipleBonds: **Mechanisms: Addition to carbon-carbon multiple bonds:** Addition reactions involving electrophiles, nucleophiles, free radicals, carbenes and cyclic mechanisms-Orientation and reactivity, hydrogenation of double and triple bonds, Michael reaction, addition of oxygen and Nitrogen **Addition to carbon-heteroatom multiple bonds:** Mannich reaction,Wittig reaction, Prins reaction. Stereochemical aspects of addition reactions.Mechanism of condensation reactions involving enolates–Stobbe reactions. Hydrolysis of esters and amides.
	UNIT-V: ReagentsandModern Synthetic Reactions: Lithium diisopropylamine (LDA), Sodium cyanoborohydride ($NaBH_3CN$), *meta*-Chloroperbenzoicacid(m-CPBA),Dimethylaminiopyridine(DMAP), n-Bu_3SnD, Triethylamine (TEA), Diethylazodicarboxylate (DEAD), *N*-bromosuccinimide(NBS),Trifluoroaceticacid(TFA),Phenyltrimethyl ammonium tribromide(PTAB).DiazomethaneandZn-Cu,Diethylmaleate

	(DEM), Copper diacetylacetonate ($Cu(acac)_2$), $TiCl_3$, $NaIO_4$, Pyridinium chlorochromate (PCC), Pyridinium dichromate (PDC), Heck reaction,Negishi reaction,Baylis-Hillman reaction.
Extended Professional Component(is a part of internal component only,Nottobe includedinthe external examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSC others to be solved (To be discussed during theTutorial hours)
Skillsacquired from this course	Knowledge,Problemsolving,Analyticalability,ProfessionalCompetency, Professional Communication and Transferable skills.
Recommended Text	1. J.MarchandM.Smith,*AdvancedOrganicChemistry*,5thed., John-Wiley and Sons. 2001. 2. E. S. Gould, *Mechanism and Structure in Organic Chemistry*, Holt, Rinehart and Winston Inc., 1959. 3. P. S. Kalsi, *Stereochemistry of carbon compounds*, 8th edn, New Age International Publishers, 2015. 4. P.Y.Bruice,*OrganicChemistry*,7th edn.,PrenticeHall,2013. 5. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee*Organic Chemistry*, 7th edn., Pearson Education, 2010.
Reference Books	1. S. H. Pine, *Organic Chemistry*, 5th edn, McGraw Hill International Editionn, 1987. 2. L.F.FieserandM.Fieser,*OrganicChemistry*,AsiaPublishing House, Bombay, 2000. 3. E.S.Gould,*Mechanism and Structure inOrganic Chemistry*,Holt, Rinehart and Winston Inc., 1959. 4. T.L.Gilchrist,*HeterocyclicChemistry*,LongmanPress, 1989. 5. J.A.JouleandK.Mills,*HeterocyclicChemistry*,4th ed.,John-Wiley, 2010.
Websiteand e-learning source	1. https://sites.google.com/site/chemistryebookscollection02/home/organic-chemistry/organic 2. https://www.organic-chemistry.org/
CourseLearningOutcomes(forMappingwithPOsandPSOs) Studentswillbeable: **CO1**: Torecallthe basic principlesofchemicalreactions. **CO2**:To understand themechanismofvarioustypesoforganicreactions.	

CO3:Topredictthesuitablereagents fortheconversionofselectiveorganic compounds.
CO4:Tocorrelatetheprinciplesofsubstitution,elimination, andadditionreactions.
CO5:To designnewroutesto synthesisorganiccompounds.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

<table>
<tr><td>Titleofthe Course</td><td colspan="8">PHYSICALCHEMISTRY-I</td></tr>
<tr><td>PaperNo.</td><td colspan="8">Core VI–CC6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td colspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hoursperweek</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 conceptsofphysicalchemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">To recall the fundamentals of thermodynamics and the composition of partial molar quantities.
Tounderstandtheclassicalandstatisticalapproachofthefunctions.
TocomparethesignificanceofMaxwell-Boltzman,Fermi-Diracand Bose-Einstein statistics.
Tocorrelatethetheoriesofreactionratesfortheevaluationof thermodynamic parameters.
Tostudythemechanismandkineticsoffastreactions.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT-I: Classical Thermodynamics: Partial molar properties-Chemicalpotential,Gibb’s-Duhemequation-binaryandternarysystems. Determinationofpartialmolarquantities.Thermodynamicsofrealgases - Fugacity- determination of fugacityby graphical and equationof state methods-dependence of temperature, pressure and composition. Thermodynamics of ideal and non-ideal binary mixtures, Duhem - Margulusequation,applicationsofidealandnon-idealmixtures.Activity andactivitycoefficients-standardstates-determination-vapourpressure, EMFandfreezingpointmethods.</td></tr>
<tr><td></td><td colspan="8">UNIT-II: Statistical thermodynamics: Introduction of statistical thermodynamics, concepts of thermodynamic and mathematical probabilities-distribution of distinguishable and non-distinguishable particles. Assemblies, ensembles, canonical particles. Maxwell - Boltzmann, Fermi Dirac & Bose-Einstein Statistics- comparison. Partition functions-evaluationoftranslational, vibrationaland rotational partitionfunctionsformonoatomic,diatomicandpolyatomicidealgases. Thermodynamic functions in terms of partition functions-calculation of equilibrium constants. Statistical approach to Thermodynamic properties: pressure, internalenergy, entropy, enthalpy, Gibb’s function,Helmholtzfunction,residualentropyandequilibrium constants.Heatcapacityofmonoanddiatomicgases-orthoandpara</td></tr>
</table>

	hydrogen.Heatcapacityofsolids-Einsteinand Debyemodels.
	UNIT-III:IrreversibleThermodynamics: Theoriesofconservationof massandenergy,entropyproductioninopensystemsbyheat,matterand currentflow,forceandfluxconcepts.Onsagertheory-validityand verification-Onsagerreciprocalrelationships.Electrokineticandthermo mechanicaleffects-Applicationofirreversiblethermodynamicsto biologicalsystems.
	UNIT-IV:KineticsofReactions: Theoriesofreactionrates-effectof temperatureonreactionrates,collisiontheoryofreactionrates, Unimolecular reactions -Lindeman and Christiansen hypothesis. Potentialenergy surfaces. Transition statetheory-evaluation of thermodynamicparametersofactivation-applicationsofARRTto reactionsbetweenatomsandmolecules.Factorsdeterminethereaction ratesinsolution-primarysalteffectandsecondarysalteffect, Homogeneouscatalysis-acid-basecatalysis-mechanismofacidbase catalyzedreactions-Bronstedcatalysislaw,enzymecatalysis-Michelis-Mentoncatalysis.
	UNIT-V:Kineticsofcomplexandfastreactions: Kineticsofcomplex reactions,reversiblereactions,consecutivereactions,parallelreactions, chainreactions.Chainreactions-chainlength,kineticsofH_2–Cl_2& H_2–Br_2reactions(ThermalandPhotochemicalreactions)-RiceHerzfeld mechanism.Studyoffastreactions-relaxationmethods-temperatureand pressurejumpmethods,electricandmagneticfieldjumpmethods-stoppedflow,flashphotolysismethodsandpulseradiolysis.Kineticsof polymerization-free radical, cationic, anionic polymerization - Polycondensation.
Extended Professional Component(isa partofinternal componentonly, Nottobe included intheexternal examination questionpaper)	Questionsrelatedtotheabovetopics,fromvarious competitive examinationsUPSC/TRB/NET/ UGC-CSIR/ GATE/TNPSCothers tobesolved (TobediscussedduringtheTutorial hours)
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.

Recommended Text	1. J.Rajaram andJ.C.Kuriacose,ThermodynamicsforStudentsof Chemistry, 2nd edition,S.L.N.Chand and Co., Jalandhar, 1986. 2. I.M.KlotzandR.M.Rosenberg,Chemicalthermodynamics,6th edition, W.A. BenjaminPublishers, California, 1972. 3. M.C.Gupta,StatisticalThermodynamics,NewAgeInternational, Pvt. Ltd., New Delhi, 1995. 4. K.J.Laidler,Chemical Kinetics,3rd edition,Pearson,Reprint- 2013. 5. J.RajaramandJ.C.Kuriokose,KineticsandMechanismsof chemicaltransformation,MacmillanIndiaLtd,Reprint-2011.
ReferenceBooks	1. D.A. Mcqurrie And J.D. Simon, Physical Chemistry - A MolecularApproach,VivaBooksPvt.Ltd.,NewDelhi,1999. 2. R.P. Rastogi and R.R. Misra, Classical Thermodynamics, Vikas Publishing, Pvt. Ltd., NewDelhi, 1990. 3. S.H.MaronandJ.B.Lando,FundamentalsofPhysicalChemistry, Macmillan Publishers, New York, 1974 4. K.B.Ytsiimiriski,"KineticMethodsofAnalysis",PergamomPress,1996. 5. GurdeepRaj, Phaserule, GoelPublishingHouse, 2011.
Websiteand e-learningsource	1. https://nptel.ac.in/courses/104/103/104103112/ 2. https://bit.ly/3tL3GdN

CourseLearningOutcomes(forMappingwithPOsandPSOs)

Studentswillbeable:
CO1:To explainthe classicalandstatisticalconceptsofthermodynamics.
CO2:Tocompareandcorrelatethethermodynamicconceptstostudythekineticsofchemical reactions.
CO3: To discuss the various thermodynamic and kinetic determination.
CO4:Toevaluatethethermodynamicmethodsforrealgasesadmixtures. **CO5**:
To compare the theories of reactions rates and fast reactions.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

MSU

<table>
<tr><td>Titleofthe Course</td><td colspan="8">ORGANICCHEMISTRYPRACTICAL-II</td></tr>
<tr><td>PaperNo.</td><td colspan="8">CoreVII– CC7</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">3</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 hoursperweek</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">3</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basicconceptsoforganicchemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">Tounderstandtheconceptofquantitativeestimationoforganic compounds.
Todevelopanalyticalskillin theestimationoforganiccompounds.
Toconstructsuitableexperimentalsetupfortheorganicpreparations involving two stages.
Toexperimentdifferentpurificationanddryingtechniquesforthe compoundprocessing.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">UNIT-I:Estimations:
a. EstimationofPhenol(bromination)
b. EstimationofAniline(bromination)
c. EstimationofEthylmethylketone(iodimetry)
d. EstimationofGlucose(redox)
e. EstimationofAscorbicacid(iodimetry)
f. Estimationof Aromaticnitrogroups(reduction)
g. EstimationofGlycine(acidimetry)
h. EstimationofFormalin(iodimetry)
i. Estimationof Acetylgroupinester (alkalimetry)</td></tr>
<tr><td colspan="8">UNIT-II: Twostage preparations:
a. p-Bromoanilinefromacetanilide
b. p-Nitroanilinefromacetanilide
c. 1,3,5-Tribromobenzenefromaniline
d. Benzilicacidfrombenzoin
e. m-Nitroanilinefromnitrobenzene
f. m-Nitrobenzoicacidfrommethylbenzoate</td></tr>
<tr><td>Extended Professional Component(isa partofinternal componentonly, Nottobe included intheexternal</td><td colspan="8">Questionsrelatedtotheabovetopics,fromvarious competitive examinationsUPSC/TRB/NET/ UGC-CSIR/ GATE/TNPSCothers tobesolved
(TobediscussedduringtheTutorial hours)</td></tr>
</table>

examination questionpaper)	
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. A.I. Vogel, Elementary Practical Organic Chemistry: Small Scale Preparations,QualitativeOrganicAnalysis,QuantitativeOrganic Analysis, Pearson Education, 2011. 2. F.G.MannandB.C.Saunders,PracticalOrganicChemistry,4thedn, Pearson Education India, 2009. 3. K.BansalRaj,LaboratoryManualofOrganicChemistry,NewAge International, 2009. 4. V.Venkateswaran,R.VeeraswamyandA.R.Kulandaivelu,Basic Principles of Practical Chemistry, Sultan Chand & Sons, 2004. 5. V.K.Ahluwalia,andR.Aggarwal,ComprehensivePracticalOrganic Chemistry, Universities Press, 2004**.**
ReferenceBooks	1. R.G.Engel,D.L.Pavia,G.M.LampmanandG.S.Kriz, *AMicroscale approach toOrganicLaboratory*, 5th edition, Paperback – International Edition, 2012. 2. P.B.Cranwell,L.M.HarwoodandC.J.Moody, *ExperimentalOrganic Chemistry*, 3rd edn, Wiley-Blackwell**,** 2017. 3. J.Leonard,B.LygoandG.Procter,*AdvancedPracticalOrganic Chemistry*, 3rd edn, CRC Press, 2013.
Websiteand e-learningsource	https://ocw.mit.edu/courses/3-091-introduction-to-solid-state-chemistry-fall-2018/video_galleries/lecture-videos/
CourseLearningOutcomes(forMappingwithPOsandPSOs) Studentswillbeable: **CO1**:Torecallthebasicprinciplesoforganic quantitativeanalysis. **CO2**: To explain the method of estimation of organic compounds. **CO3**: To develop the skills to estimate organic compounds. **CO4**:Todeveloptheskillstohandlecorrosiveandtoxicchemicalsinorganicpreparations. **CO5**:Tocategorizeorganicreactionsandtheirmechanismsrelevanttoorganicpreparations.	

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand 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
WeightedpercentageofCourse Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

MSU

<table>
<tr><td>TitleoftheCourse</td><td colspan="7">INORGANICCHEMISTRYPRACTICAL-I</td></tr>
<tr><td>PaperNo.</td><td colspan="7">CoreVIII– CC8</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>-</td><td>1</td><td colspan="3">3</td><td>4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basicprinciplesofqualitativeanalysis</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="7">Tolearntheprinciples and methods ofqualitative analysis of familiar and less familiar cations present in a mixture.
To identifythemethodologyto analyze qualitativelya metalionin thepresenceof another metalion.
Torecalltheprincipleand theoryinpreparing standard solutions.
Totrainthestudentsforimprovingtheirskillinestimatingthe amount of ion accuratelypresent in the solution</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I: Analysis of mixture of cations: Analysis ofa mixture of four cationscontaining two commoncationsand two rare cations. Cationsto be tested.
Group-I :Wand Pb.
GroupIA :Se,Te
Group-II : Mo, Cu, Bi and Cd.
Group-III :Ce,Th,Zr,V,Cr,andTi.
Group-IV : Zn, Ni, Co and Mn.
Group-V: Ba andSr.
Group-VI : Li.</td></tr>
<tr><td></td><td colspan="7">UNIT-II:ComplexometricTitration:
1. Estimationofzinc,nickel,magnesium,andcalcium.
2. Estimationofmixtureofmetalions-pHcontrol,maskingand demasking agents.
3. Determinationofcalciumandleadinamixture(pH control).
4. Determinationofmanganeseinthepresenceof iron.
5. Determinationofnickelinthe presence ofiron.</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination questionpaper)</td><td colspan="7">Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved
(TobediscussedduringtheTutorial hours)</td></tr>
<tr><td>Skillsacquired fromthiscourse</td><td colspan="7">Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">1. A.JeyaRajendran,MicroanalyticalTechniquesinChemistry:Inorganic Qualitative Analysis, United global publishers, 2021.
2. V. V. Ramanujam,Inorganic Semimicro Qualitative Analysis; 3rded., The National Publishing Company, Chennai, 1974.
3. Vogel’sTextbookofInorganicQualitativeAnalysis,4thed.,ELBS,</td></tr>
</table>

	London. 4. G.H.Jeffery,J.Bassett,J.MendhamandR.C.Denney,Vogel'sTextbookof Quantitative Chemical Analysis, Revised 5th edition, ELBS, 1989. 5. DouglasA.Skoog,DonaldM.West,F.JamesHollerandStanleyR.Crouch, FundamentalsofAnalyticalChemistry,8th Edition,Brooks/Cole-Thomson Learning,USA,2004.
ReferenceBooks	1. G. Pass, andH.Sutcliffe,*PracticalInorganic Chemistry*;ChapmanHall, 1965. 2. W.G.Palmer,Experimental*InorganicChemistry*;CambridgeUniversity Press, 1954.

CourseLearningOutcomes(forMappingwithPOsandPSOs)

Studentswillbeable:

CO1:Toexplaintheprinciplesandtechniquesand haveskillsofqualitativeanalysisoffamiliar and less familiar cations in a mixture.

CO2:To analyzeametalion inthepresenceofanothermetal ion.

CO3: To acquire the qualitative analytical skills by selecting suitable confirmatory tests and spot tests.

CO4:Todescribetheprinciples, techniquesandskillsrelatedtoquantitativedetermination of ions in a mixture by complexometric titration.

CO5:Toestimateonemetalion inpresenceofanother metalionbycomplexometricmethod.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

<table>
<tr><td>Titleofthe Course</td><td colspan="7">MEDICINALCHEMISTRY</td></tr>
<tr><td>PaperNo.</td><td colspan="7">ElectiveIII–EC3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td>1</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basicknowledgeofmedicinalchemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="7">Tointroducethe mechanismofdrugactionanddrugdeliverysystem To learn various types of drugs and their mode of action.
To learndrugdesignand drugsynthesis.</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="7">UNIT-I: Introduction to receptors: Introduction, targets, Agonist, antagonist, partialagonist. Receptors, Receptor types, Theories of Drug –receptorinteraction, Drugsynergism,Drugresistance,physicochemical factorsinfluencingdrug action.</td></tr>
<tr><td colspan="7">UNIT-II: Antibiotics: Introduction, Targets of antibiotics action, classificationofantibiotics,enzyme-basedmechanismofaction,SARof penicllinsandtetracyclins,clinicalapplicationofpenicillins, cephalosporin.Currenttrendsinantibiotictherapy.</td></tr>
<tr><td colspan="7">UNIT-III: Antihypertensive agents and diuretics: Classification of cardiovascular agents, introduction to hypertension, etiology, types, classification of antihypertensive agents, Synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolol. Classificationandmechanismofactionofdiuretics,Furosemide, Hydrochlorothiazide,Amiloride.</td></tr>
<tr><td colspan="7">UNIT-IV:AntineoplasticAgents
Antineoplastic Agents: Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer - Introduction of carcinolytic antibiotics and mitotic inhibitors - Synthesisofmechlorethamine,cyclophosphamide,melphalan,anduracil -Recent developmentincancerchemotherapy.</td></tr>
<tr><td colspan="7">UNIT-V: Analgesics, Anti-inflammatory and Antidiabetic Drugs: Introduction, Mechanism of inflammation, classification and mechanismofactionandparacetamol,Ibuprofen,Diclofenac,naproxen, indomethacin,phenylbutazoneandmeperidine.</td></tr>
</table>

	Antidiabetic Agents: Introduction, Types of diabetics, Drugs used for thetreatment,chemical classification,Mechanismofaction,Treatment ofdiabeticmellitus. Chemistryofinsulin,sulfonylurea.
Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved (TobediscussedduringtheTutorial hours)
Skills acquired fromthiscourse	Knowledge, Problem solving, Analytical ability, Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. WilsonandGisvold'stextbookoforganicmedicinaland pharmaceutical chemistry, 2. Wilson,CharlesOwens:Beale,JohnMarlowe;Block,JohnH, Lipincott William, 12th edition, 2011. 3. Graham L. Patrick, An Introduction to Medicinal Chemistry, 5th edition, Oxford University Press, 2013. Jayashree Ghosh, A text book of Pharmaceutical Chemistry, S. Chand and Co. Ltd, 1999, 1999 edn. 4. O.LeRoy,Naturalandsyntheticorganicmedicinalcompounds, Ealemi, 1976. 5. S.AshutoshKar,MedicinalChemistry,WileyEasternLimited,New Delhi, 1993, New edn.
ReferenceBooks	1. Foye'sPrinclesofMedicinalChemistry, Lipincott Williams, Seventh Edition, 2012 2. Burger'sMedicinalChemistry,DrugDiscoveryandDevelopment, Donald J. Abraham, David P. Rotella, Alfred Burger, Academic press, 2010. 3. Wilson and Gisvold's Textbook of Organic Medicinal and PharmaceuticalChemistry,JohnM.BealeJrandJohnM.Block, Wolters Kluwer, 2011, 12th edn. 4. P.Parimoo,ATextbookofMedicalChemistry,NewDelhi:CBS Publishers.1995. 5. S. Ramakrishnan, K. G. Prasannanand R. Rajan, Textbook of Medical Biochemistry,Hyderabad: Orient Longman. 3rd edition, 2001.
Websiteand e-learningsource	1. https://www.ncbi.nlm.nih.gov/books/NBK482447/ 2. https://training.seer.cancer.gov/treatment/chemotherapy/types.html 3. https://www.classcentral.com/course/swayam-medicinal-chemistry-

	12908

CourseLearningOutcomes(forMappingwithPOsandPSOs)
Studentswillbeable:
CO1:Topredictdrugsproperties basedonitsstructure.
CO2:Todescribethefactorsthataffectitsabsorption,distribution,metabolism,andexcretion, and hence the considerations to be made in drug design.
CO3:Toexplaintherelationshipbetweendrug'schemicalstructureanditstherapeutic properties.
CO4:Togivetheknowledgeofdifferenttheories ofdrugactionsatmolecularlevel.
CO5: To identify different targets for the development of new drugs for the treatment ofcancer.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

<table>
<tr><td>Titleofthe Course</td><td colspan="8">GREENCHEMISTRY</td></tr>
<tr><td>PaperNo.</td><td colspan="8">ElectiveIII– EC3</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>3</td><td>1</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basicknowledge ofgeneralchemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">TounderstandthebasicprinciplesofGreenchemistryandGreentechniques.
To studyGreencatalysisand Greensolvents.
To propose solutions for pollutionprevention in Industrialchemicaland fuel production, Automotive industry and Shipping industries.
ToproposegreensolutionsforindustrialproductionofOrganicand inorganicchemicals.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT-I: Basic Principles of Green Chemistry: Introduction- Need for GreenChemistry. Goals of GreenChemistry. Limitations of GreenChemistry. Chemical accidents, terminologies, International green chemistry organizations and Twelve principles of Green Chemistry with examples.</td></tr>
<tr><td></td><td colspan="8">UNIT-II: Green Synthesis: Choice of starting materials, reagents, catalysts and solvents in detail, Green chemistry in day today life. Designing green synthesis-Green reagents: dimethyl carbonate. Green solvents: Water, Ionic liquids - criteria, generalmethodsofpreparation, effect on organic reaction. Supercritical carbon dioxide- properties, advantages, drawbacks and a few examples of organic reactions in scCO_2. Green synthesis-adipic acid and catechol.</td></tr>
<tr><td></td><td colspan="8">UNIT-III:GreenCatalysis:Environmentalpollution,GreenCatalysis-Acid catalysts, Oxidation catalysts, Basic catalysts, Polymer supported catalysts-Polystyrenealuminumchloride,polymericsuperacidcatalysts, Polymer supported photosensitizers.</td></tr>
<tr><td></td><td colspan="8">UNIT-IV: Greener Reactions: Phase transfer catalysis in green synthesis-oxidation using hydrogen peroxide, crown ethers-esterification, saponification, anhydride formation, Elimination reaction, Displacement reaction. Applications in organic synthesis.</td></tr>
</table>

	UNIT-V: Green Techniques: Micro wave induced green synthesis - Introduction, Instrumentation, Principle and applications. Sonochemistry–Instrumentation,Cavitationtheory-Ultrasound assistedgreensynthesisandApplications.
Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination questionpaper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved (TobediscussedduringtheTutorial hours)
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. Ahluwalia,V.K.andKidwai,M.R.NewTrendsinGreenChemistry, Anamalaya Publishers, 2005. 2. W.L.McCabe,J.C.SmithandP.Harriott,UnitOperationsof ChemicalEngineering,7th edition,McGraw-Hill,NewDelhi,2005. 3. J.M.SwanandD.St.C.Black,OrganometallicsinOrganic Synthesis, Chapman Hall,1974. 4. V.K.AhluwaliaandR.Aggarwal,OrganicSynthesis:Special Techniques, Narosa Publishing House, New Delhi,2001. 5. A.K.De,EnvironmentalChemistry,NewAgePublications, 2017.
ReferenceBooks	1. Anastas,P.T.andWarner,J.K.OxfordGreenChemistry-Theoryand Practical, University Press, 1998 2. Matlack,A.S.IntroductiontoGreenChemistry,MarcelDekker,2001 3. Cann,M.C.andConnely,M.E.Real-WorldCasesinGreenChemistry, American Chemical Society, Washington, 2000 4. Ryan,M.A.andTinnesand,M.,IntroductiontoGreenChemistry, American Chemical Society Washington, 2002. 5. ChandrakantaBandyopadhyay,AnInsightintoGreenChemistry, Booksand Allied(P)Ltd, 2019.
Websiteand e-learningsource	2. https://www.organic-chemistry.org/ 3. https://www.studyorgo.com/summary.php

CourseLearningOutcomes(forMappingwithPOsandPSOs)

Studentswillbeable:

CO1:Torecallthebasicchemicaltechniquesused inconventionalindustrialpreparationsand in green innovations.

CO2: To understand the various techniques used in chemical industries and in laboratory.

CO3: To compare the advantages of organic reactions assisted by renewable energy sources and non-renewable energy sources.

CO4:To applytheprinciplesofPTC, ionic liquid, microwaveandultrasonicassistedorganic synthesis.

CO5:Todesignandsynthesizeneworganiccompoundsbygreen methods.

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

<table>
<tr><td>Titleofthe Course</td><td colspan="8">BIOINORGANIC CHEMISTRY</td></tr>
<tr><td>PaperNo.</td><td colspan="8">ElectiveIV–EC4</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">3</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 hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>3</td><td>1</td><td colspan="3">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basicknowledgeofchemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">To understand therole oftrace elements.
Tounderstandthebiologicalsignificanceofironandsulphur. To study the toxicity of metals in medicines.
Tohaveknowledgeondiagnostic agents.
Todiscussonvariousmetalloenzymesproperties.</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Essential trace elements: Selective transport and storage of metalions:Ferritin,Transferrinandsiderophores;Sodiumandpotassium transport, Calcium signaling proteins. Metalloenzymes: Zinc enzymes–carboxypeptidase and carbonic anhydrase. Iron enzymes–catalase, peroxidase.Copperenzymes–superoxidedismutase,Plastocyanin, Ceruloplasmin,Tyrosinase.Coenzymes-Vitamin-B12coenzymes.</td></tr>
<tr><td colspan="8">UNIT-II: Transport Proteins: Oxygen carriers - Hemoglobin and myoglobin-StructureandoxygenationBohrEffect.BindingofCO,NO, CN^- to Myoglobin and Hemoglobin. Biological redox system: Cytochromes-Classification, cytochromea, bandc. CytochromeP-450. Non-hemeoxygencarriers-Hemerythrinandhemocyanin.Iron-sulphur proteins-RubredoxinandFerredoxin- Structureandclassification.</td></tr>
<tr><td colspan="8">UNIT-III: Nitrogen fixation: Introduction, types of nitrogen fixing microorganisms. Nitrogenase enzyme - Metal clusters in nitrogenase-Transition metal complexes of dinitrogen - nitrogen fixation via nitride formationandreductionofdinitrogentoammonia.Photosynthesis: photosystem-Iandphotosystem-II-chlorophyllsstructureandfunction.</td></tr>
<tr><td colspan="8">UNIT-IV: Metals in medicine: Metal Toxicity of Hg, Cd, Zn, Pb, As, Sb. Therapeutic Compounds: Vanadium-Based Diabetes Drugs; Platinum-Containing Anticancer Agents. Chelation therapy; Cancer treatment.DiagnosticAgents:TechnetiumImagingAgents;Gadolinium MRIImagingAgents.</td></tr>
<tr><td colspan="8">UNIT-V:Enzymes-Introductionandproperties-nomenclatureand</td></tr>
</table>

	classification.Enzymekinetics, freeenergyofactivationandtheeffects ofcatalysis.Michelis-Mentonequation-EffectofpH,temperatureon enzymereactions.Factorscontributingto theefficiencyofenzyme.
Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination questionpaper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved (TobediscussedduringtheTutorial hours)
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. Williams,D.R.–IntrodutiontoBioinorganicchemistry. 2. F.M. Fiabre and D.R. Williams– The Principles of Bioinorganic Chemistry,RoyolSoceityofChemistry, Monographfor Teachers-31 3. K.F.PurcellandKotz.,Inorganicchemistry,WBSaundersCo., USA. 4. G.N.MugherjeaandArabindaDas,ElementsofBioinorganic Chemistry - 1993. 5. R.Gopalan,V.Ramalingam,*ConciseCoordinationChemistry*, S.Chand, 2001.
ReferenceBooks	1. M.SatakeandY.Mido,BioinorganicChemistry-DiscoveryPublishing House, New Delhi (1996) 2. M.N.Hughes,1982,TheInorganicChemistryofBiologicalprocesses, II Edition, Wiley London. 3. R.W.Hay,Bio InorganicChemistry,EllisHorwood,1987. 4. R.M.Roat-Malone,BioInorganicChemistry,JohnWiley, 2002. 5. T.M.Loehr,IroncarriersandIronproteins,VCH,1989.
Websiteand e-learningsource	1. https://www.pdfdrive.com/instant-notes-in-inorganic-chemistry-the-instant-notes-chemistry-series-d162097454.html 2. https://www.pdfdrive.com/shriver-and-atkins-inorganic-chemistry-5th-edition-d161563417.html
CourseLearningOutcomes(forMappingwithPOsandPSOs) Studentswillbeable: **CO1**: Toanalyze trace elements. **CO2**:Toexplainthebiologicalredoxsystems. **CO3**:Togainskillinanalyzingthetoxicityinmetals. **CO4**:Togetexperienceindiagnosis. **CO5**:Toexplainnitrogenfixationandphotosyntheticmechanism.	

CO-POMapping(CourseArticulation Matrix)

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

3–Strong, 2 –Medium,1-Low

LevelofCorrelationbetweenPSO'sand CO's

CO/PSO	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
WeightedpercentageofCourse ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

MSU

<table>
<tr><td>Titleofthe Course</td><td colspan="8">MATERIALSCIENCE</td></tr>
<tr><td>PaperNo.</td><td colspan="8">ElectiveIV– EC4</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>3</td><td>1</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basicknowledgeofsolid-statechemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">Tounderstandthecrystalstructure,growthmethodsandX-rayscattering. To explain the optical, dielectric and diffusion properties of crystals.
To recognize the basis of semiconductors,superconductivity materials and magnets.
Tolearnabouttheimportanceofmaterialsusedforrenewableenergy conversion.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT-I: Crystallography: symmetry - unit cell and Miller indices - crystalsystems-Bravaislattices-pointgroupsandspacegroups-X-ray diffraction-Laue equations-Bragg's law-reciprocal lattice and its applicationtogeometricalcrystallography.Crystalstructure–powderand singlecrystalapplications.Electronchargedensitymaps,neutron diffraction-methodandapplications.</td></tr>
<tr><td></td><td colspan="8">UNIT-II: Crystal growth methods: Single crystal –Low and high temperature, solutiongrowth– Geland sol-gel. Crystalgrowth methods-nucleation– equilibriumstability and metastable state. Melt growth - Bridgeman-Stockbarger,Czochralskimethods. Flux technique, physical andchemicalvapourtransport.Lorentzandpolarizationfactor-primary and secondary extinctions.
Characterization–TG/DTA/DSCmethods,SEM/TEMAnalysis.
DeterminationofHardness,ApplicationsofSingleCrystals.</td></tr>
<tr><td></td><td colspan="8">UNIT-III: Properties of crystals: Optical studies - Electromagnetic spectrum (qualitative) refractive index – reflectance – transparency, translucencyand opacity. Typesofluminescence – 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. dielectricconstant,dielectricloss.Typesofdielectricbreakdown– intrinsic,thermal,discharge,electrochemicalanddefectbreakdown.</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 – DomaintheoryHysteresisLoop-Applications. Magnetoand giant magnetoresistance. 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-SecondHarmonicGenerators,mixingofLaserwavelengthsbyquartz, rubyandLiNbO$_3$.
	UNIT-V: Materials forRenewable Energy Conversion: Solar Cells: Organic, bilayer, bulk heterojunction, polymer, perovskite based. Solar energyconversion: lamellar solids and thin films, dye-sensitized photo voltaic cells, coordination compounds anchored to semiconductor surfaces - Ru(II) and Os(II) polypyridyl complexes. Photochemical activation and splitting of water, $CO_2$and N_2. Manganese based photo systemsforwater-splitting.ComplexesofRh,Ru,PdandPt-photochemicalgenerationofhydrogenfromalcohol.
Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination questionpaper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved (TobediscussedduringtheTutorial hours)
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. S.MohanandV.Arjunan,PrinciplesofMaterialsScience,MJP Publishers, 2016. 2. Arumugam,MaterialsScience,AnuradhaPublications,2007. 3. Giacavazzoet.al.,FundamentalsofCrystallography,International Union of Crystallography. Oxford Science Publications, 2010 4. Woolfson,AnIntroductiontoCrystallography,CambridgeUniversity Press, 2012. 5. JamesF.ShackelfordandMadanapalliK.Muralidhara, Introduction toMaterialsScienceforEngineers.6thed.,PEARSONPress, 2007.
ReferenceBooks	1.SuggestedReadings1.M.G.Arora,SolidStateChemistry,Anmol Publications, New Delhi, 2001. 2. R.K.PuriandV.K.Babbar,SolidStatePhysics,SChandandCompany

	Ltd,2001. 3..C. Kittel,SolidStatePhysics,John-Wileyandsons,NY,1966. 4. H.P.Meyers,Introductory SolidState Physics,VivaBooksPrivate Limited, 1998. 5. A.R.West,SolidStateChemistryandApplications,John-Wileyand sons,1987.
Websiteand e-learningsource	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

CourseLearningOutcomes(forMappingwithPOsandPSOs)

Studentswillbeable:

CO1:Tounderstandandrecallthesynthesisandcharacteristicsofcrystalstructures, semiconductors, magnets and renewable energy materials.

CO2:Tointegrateandassessthestructureofdifferentmaterialsandtheirproperties.

CO3:Toanalyseandidentifynewmaterialsforenergyapplications.

CO4: To explain the importance of crystal structures, piezoelectric and pyroelectric materials, nanomaterials, hard and soft magnets, superconductors, solar cells, electrodes, LED uses, structures and synthesis.

CO5:Todesignanddevelopnewmaterialswithimprovedpropertyforenergyapplications.

CO-POMapping(CourseArticulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	M
CO2	M	S	S	S	S	M	S	S	S	S
CO3	S	S	M	S	S	S	S	M	S	S
CO4	M	S	S	S	S	M	S	S	S	S
CO5	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/PSO	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
WeightedpercentageofCourse ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low

<table>
<tr><td>Titleofthe Course</td><td colspan="8">COMPUTATIONALCHEMISTRY</td></tr>
<tr><td>PaperNo.</td><td colspan="8">SkillEnhancementCourse –SEC1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td><td colspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">2</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basicknowledgeofchemistry</td></tr>
<tr><td>Objectivesofthe course</td><td colspan="8">To understand theconceptofComputationalchemistry.
To impart skills on use of various chemistry tools that are essential for any student with chemistry as a major course.
Tolearnthetechniquesofmolecularsimulationswhichwillenhancethe students’employabilityinacademiaandindustry.</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="8">UNIT-I:Basics:NeedofComputationalChemistry–ToolsofComputational Chemistry: Molecular Mechanics – Force field – Principles of Molecular mechanics–MeritsandDemerits.Abinitiocalculations:Principlesofabinitio method – Hartree fock equations – Merits and Demerits. Semi empirical calculations : Basic principles – PPP, CNDO, INDO and NDDO methods – MeritsandDemerits.DensityFunctionalcalculations–Basicprinciples–Kohn-Shamapproach–MeritsandDemerits.</td></tr>
<tr><td colspan="8">UNIT- II: Applications of Computational Chemistry: – Geometry optimization – Vibrational frequencyanalysis – Dipole moment – Bond order–Charges:Mulliken,NaturalandHirshfeldCharges–UVand NMRspectra,Electronegativity,Hardness,Softness,Fukuifunction.</td></tr>
<tr><td colspan="8">UNIT- III: Molecular Docking: Online servers for the selection of macromoleculesand ligands – RCSB – Chemdata base – Online servers to detect druglikeness of compound - Swiss ADME – Molinspiration – ADMETservers–Preparationofmacromoleculeandligand–Autodock Vina – Binding energy – Types of interactions between macromolecule andligand-Molecularinteractionvisualizingsoftwares–Discovery Studio.</td></tr>
<tr><td colspan="8">UNIT-IV:Computingsoftware–I:Introductionandstepwiseapproach to Chemdraw, ACD/Chemsketch and Argus Lab.
Exercises:
1.Drawing the structures of organic molecules and reaction schemes using Chemdraw or ACD/Chemsketch.</td></tr>
</table>

	2. Geometryoptimizationandsinglepointenergycalculationsof simple organic molecules. 3. Calculationofdipolemomentinpolarorganicmolecules.
	UNIT- V: ComputingSoftware–II: IntroductionandstepwiseapproachtoAVOGADRO,Molinspiration, SwissADME, SwissDock, and Autodock. **Exercises:** 1. Calculation of molecular properties and bioactivity of the simple drug molecules like aspirin, paracetamol, and the drugs of your choices using the online server molinspiration. 2. Prediction of drug likeliness, ADME and Toxicity of the drug classes like antibiotics, antihistamines, anesthetics and drug molecules of your choice using online server SwissADMEor SwissDock. 3. PerformmoleculardockingofyourchoiceusingAutodocktoolsor AutodockVinaorArgusLab.
Extended Professional Component (is a part of internal component only, Nottobeincluded in the external examination questionpaper)	Questions related to the above topics, from various competitive examinationsUPSC/TRB/NET/UGC-CSIR/GATE /TNPSCothers to be solved
Skillsacquired fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. FrankJensen,IntroductiontoComputationalChemistry,Third Edition, John Wiley & Sons, 2017. 2. AndrewR.Leach,Molecularmodelling:principlesandapplications, Second Edition, Prentice-Hall, 2001. 3. ChristopherJ.Cramer,EssentialsofComputationalChemistry: TheoriesandModels, SecondEdition,JohnWiley&Sons,2004.
ReferenceBooks	1. JanH.Jensen,MolecularModellingBasics,CRCPress,2010. 2. Waren J. Hehre, Alan J. Shusterman and Janet E. Nelson, The molecular modelling workbookfororganicchemistry, Wavefunction Inc., 1998. 3. James B. Foresman and Eleen Frisch, Exploring Chemistry with Electronic Structure Methods, Gaussian Inc., Third Edition, 2015.

Websiteand e-learningsource	1. https://onlinecourses.nptel.ac.in/noc20_cy08/preview 2. https://www.digimat.in/nptel/courses/video/104106122/L14.html

CourseLearningOutcomes(forMappingwithPOsandPSOs)

Studentswillbeable:

CO1: Todescribe thebasicandneedofComputationalChemistry.

CO2: To understand theapplicationsofComputationalChemistrymethods.

CO3: Togainknowledgeabouttheolecular docking.

CO4: Tousechemicalsoftwarefordrawingchemicalstructures,reactionschemesand generation of their names.

CO5: To perform molecular docking in structural molecular biology and computer assisted drug design which enhance their employability in academia and industry.

CO-POMapping(CourseArticulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO5	**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/PSO	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
WeightedpercentageofCourse ContributiontoPSOs	3.0	3.0	3.0	3.0	3.0

3–Strong, 2 –Medium,1-Low