# Annexure: I

Faculty of Science Department of Chemistry Ordinance, Curriculum & Syllabus Master of Science (Chemistry)

(2020-21)



Shree Guru Gobind Singh Tricentenary University, Gurugram (Haryana)- 122505, India

# SHREE GURU GOBIND SINGH TRICENTENARY (SGT) UNIVERSITY, BUDHERA, GURUGRAM (HARYANA) FACULTY OF SCIENCE MASTER OF SCIENCE [CHEMISTRY] ORDINANCE

# 1. PREAMBLE

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of the country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning (online & offline) process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system.

Department of Chemistry, Faculty of Science, Shree Guru Gobind Singh Tricentenary University, Gurugram with the aim to enhance academic standards in quality of higher education has adopted the UGC guidelines in its Postgraduate (PG) program (M. Sc. Chemistry).

The grading system is considered to be better than the conventional marks system and in order to facilitate student mobility across institutions within India and across countries the community grade point average (CGPA) has been introduced in this PG program. The guidelines are as follows:

#### **CHOICE BASED CREDIT SYSTEM (CBCS):**

The CBCS provides an opportunity for the students to choose courses from the prescribed pool of courses comprising core, elective, skill and ability enhancement courses. The courses can be evaluated by a uniform grading system in the higher education system. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in the evaluation

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system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

#### **Outline of Choice Based Credit System:**

- a. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
- b. Elective Course: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
  - i. **Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
  - ii. **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
- c. Skill Enhancement Course: The course based upon the content that leads to Knowledge enhancement.
- d. Ability Enhancement Compulsory Course: The course based upon the content that leads to the development of a professional of ability.
- e. **Open Elective Course:** The course based upon the content that enhances interdisciplinary knowledge

#### 2. Program Educational Objectives (PEOs):

- i. To set up a broad foundation in chemistry leading to critical thinking, scientific learning and problem solving attitude.
- ii. To engage in and conduct original research in chemistry and interdisciplinary areas.
- iii. To train the students in performing and publishing experimental investigations among the scientific communities leading to self-learning, ethical awareness and sustainable development of the society.

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- iv. To become experts and leaders in the different areas of specialization in chemistry.
- v. To successfully pursue their career in research, academics, entrepreneurship and industry.

#### 3. Program Outcomes (POs):

On successful completion of the Program, students will have the ability to:

#### PO 1. Disciplinary Knowledge:

Demonstrate the comprehensive knowledge of both theoretical and experimental chemistry in various fields of interest like Physical Chemistry, Inorganic Chemistry and Organic Chemistry.

#### PO 2. Critical Thinking and Problem Solving:

Develop critical thinking for identifying, analyzing and solving different kinds of theoretical / experimental problems by following scientific approach to knowledge development.

#### PO 3. Analytical / Scientific Reasoning:

Apply appropriate techniques for the qualitative and quantitative analysis of chemical compounds and explore the scientific reasoning for the obtained results.

#### PO 4. Research Related Skills:

Plan and write basic chemistry research projects while keeping in mind the rules and regulations pertaining to different scientific research project operations.

#### PO 5. Effective Communication:

Demonstrate the subject knowledge through technical writings as well as oral presentations among the scientific community and society.

#### PO 6. Social Interaction and Effective Citizenship:

Present the experimental investigations at various technical platforms such as Conferences /Seminars/ Symposia/Workshops and also contribute to the future development of the nation through their Voluntary participation in civic life.

#### PO 7. Multicultural Competency and Leadership Readiness:

Work effectively either independently or as a team leader while being adaptable to various multicultural professional environments.

PO 8. Ethics:

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Develop ethical awareness, exercise empathy and a caring attitude while maintaining professional integrity, honesty and high ethical standards.

# PO 9. Environment and Sustainability:

Follow and practice processes leading to safe environment and sustainable development while carrying out activities in the laboratory.

# PO 10. Self-directed and Life-long Learning:

Inculcate a habit of self-learning continuously through various online/offline educational platforms for personal academic growth as well as for increasing employment opportunity.

# 4. Definitions

- i. **Course** means a unit of teaching / individual subject comprising of Lectures, Tutorials and / or Lab that typically lasts one academic term (semester / year) led by one or more instructors (teachers or professors), and has a fixed roster of students. Each Course shall have an individual Course Code e.g. Transition Metal Chemistry (theory) and Inorganic Chemistry Practical-I (Lab) to be given separate course codes.
- ii. Credit means a unit by which course work is measured. One hour of lecture / tutorial is equal to one credit and one hour of lab / workshop / project etc. is equal to half credit.
- iii. Program means any combination of courses and/or requirements leading to a degree, diploma or certificate e.g. M.Sc. (Chemistry).
- iv. **Program Structure** means listing of various courses of a program and the credits associated with them as L-T-P structure which indicates the number of lecture hours/week, number of tutorial hours/week and number of practical hours/week to be devoted for each course e.g. Organic Spectroscopy (3-0-2). This means that this course shall have 3 hours of lecture per week and 4 hours of practical work per week.
- v. Scheme of Study means the Academic Term wise listing of all the courses along with distribution of their formative and summative assessment criteria, which will be normally offered during the entire Program.
- vi. Semester Grade Point Average (SGPA) means the ratio of sum of the product of the number of credits with the numerical grade scored by a student in all the courses taken by a student in a particular Semester and the sum of the number of credits of all the Courses undergone by a student, i.e. SGPA(Si) =∑ (Ci x Gi) /∑Ci.



- vii. Cumulative Grade Point Average (CGPA) means the ratio of sum of the product of the number of credits with the numerical grade scored by a student in all the courses taken by a student in all Semesters and the sum of the number of credits of all the Courses undergone by a student i.e, CGPA = $\Sigma$ (Ci x Si) /  $\Sigma$ Ci.
- viii. **Open Elective Course** means a course offered by a Department / Faculty other than the parent Department / Faculty.

#### 5. Duration and Nomenclature of the Program:

The duration of M.Sc. Chemistry program shall be of two academic years consisting of four (04) semesters (16 weeks per semester) under Choice Based Credit System (CBCS). On successful completion of all the four semesters, the student will be awarded M.Sc. Chemistry degree. The student shall complete the program within a maximum period of 4 years from the date of admission to the first semester as per N+2 rule by UGC (where N stands for minimum duration years of the program). However, in exceptional circumstances a further extension of one more year may be granted. In such cases, permission from competent authorities of the University is mandatory, failing which he/she will be disqualified from the program.

# 6. Eligibility criteria for Admission in a Program

For admission to the 1<sup>st</sup> Semester of M.Sc. (Chemistry) program, the candidate must have passed B.Sc. (Pass) with Chemistry as one of the subjects/B.Sc. (Hons.) Chemistry with 50% marks (45% marks in case of SC/ST candidates of Haryana only) in aggregate or equivalent grade from any university recognized by UGC.

#### 7. Registration of Courses at the start of an academic term

Every student admitted in a Program shall be required to register various courses which he/she needs to undergo in a particular Semester as per the approved Scheme of Study applicable to M.Sc. Chemistry Program in the prescribed format within the defined timelines.

#### 8. Medium of Instructions:

The medium of the instructions for all Programs shall be English only.

# 9. Scheme of Study and Syllabi

(i) Scheme of Study and Syllabi shall be governed by the UGC regulations.

- (ii) In M.Sc. Chemistry, formal classes / labs shall be held for 5 days in a week i.e. Monday to Friday and Saturday shall be reserved for Professional Activities (Curricular / Co-curricular and Extra-Curricular).
- (iii)Minimum number of Credits required to earn M.Sc. Chemistry degree shall be 82 credits.
- (iv)Provision has been made in the Scheme of Study for students to earn up to three credits in each Semester through online MOOC courses on the specified portals.
  For example, a student may enroll in the courses offered on SWAYAM platform of the Government of India (<u>https://swayam.gov.in/</u>). The courses offered on SWAYAM on SWAYAM portal are offered by the top ranked Universities / Institutions of National Importance spanning 4-12 weeks in higher education domain. A 4-week, 8 week and 12 or more week courses may have 1, 2 & 3 credits respectively. The credits will be accepted if the student appears in the term end examination conducted by the host institution and earns credits for the same with appropriate grade. Similarly, other such platforms may be identified by the department time to time.
- (v) For Open Elective Course, a slot of one hour (preferably last lecture) during first three days of the week (Monday to Wednesday) for the whole semester will be earmarked in the time table.
- (vi)The syllabus of various theory courses has been designed and distributed in four units and is balanced in terms of Academic workload (e.g. the syllabus has been designed in such a way that the entire theory syllabus is to be covered in 11C hours where C means number of credits per week. 2C/3C hours shall be utilized for discussing performance of the students in class test/assignment and covering currently relevant topics related to the subject).
- (vii) The weightage of continuous/ formative evaluation and term-end/ summative evaluation for theory classes is in the ratio of 40 and 60 respectively. Every course has 100 marks for evaluation.
- (viii) Continuous/ Formative Evaluation of theory courses is done in following manner:
  - a) Mid Semester Examination (Subjective/Objective, Average of two) : 20 Marks
  - b) Assignments (Average of two) :10 Marks
  - c) Professional Activities (Problems/Projects/Seminars/Case Study etc.) : 10 Marks

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- (ix)A student will be required to register for Professional Activities in the very beginning of the Academic Term (semester) which will be open ended and consists of curricular / co-curricular / extra-curricular activities. Such activities will include extra projects beyond syllabus (SGTU Synergy / Competitive Projects such as Hackathon / Robocon /BAJA/ SAE etc.), extension and activities related to clubs / societies / chapters of professional bodies / NSS / NCC / Sports etc. Each such activity shall be undertaken by the student under the supervision of a Faculty Member who will keep records of the activity undertaken by the student. Faculty Mentor concerned shall be informed about all the activities being undertaken by every student. Each student shall maintain a diary / log book of activities perform by her/him which will be countersigned by the Faculty Activity in-charge on fortnightly basis. Three weeks before the last day of classes, every student shall submit a portfolio of activities performed by him/her along with diaries / log books to the Faculty Mentor concerned. Head of the Department concerned shall constitute a Portfolio Evaluation Committee consisting of two Faculty members of the Department and a representative of Dean Student Welfare. Portfolio Evaluation Committee shall evaluate the performance of each student separately and award marks on scale of 0 to 10 based upon the efforts put by each student and the outcomes. Portfolio Evaluation Committee shall submit the evaluation report to the Head of the Department concerned who after satisfying herself/himself about the quality of evaluation shall notify the marks to all the Teachers taking theory classes in that Semester for incorporating marks earmarked for professional activities. Such professional activities shall be undertaken on week days after working hours and Saturdays. This provision / evaluation shall measure the group activities, attitude and behavior of the student.
- (x) The weightage of continuous/formative evaluation and term-end/summative evaluation of lab classes/summer training/project work are in the ratio of 60 and 40 respectively. Every lab course has 100 marks for evaluation.
- (xi)Continuous/Formative Evaluation of lab courses is done in following manner:
  - a) Attendance and Regularity in Lab Work : 10 Marksb) Lab/Project Work Report : 10 Marks
  - c) Mid Term Oral Exam./ Assessment
  - d) Conduct/ Demonstration

30 Marks

10 Marks

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The distribution of formative (internal) assessment marks for the summer training and project work to be kept in-line with the above.

# 10. Teacher Diary and Course File

- Every faculty member should maintain a separate Teacher Diary and a Course file for each course including lab courses.
- (ii) Teacher Diary will be maintained in the pre-printed booklet issued from the university store which consists of Index, Syllabus (Theory and Lab), Subject Time Table, Course plan, Daily Diary (Course Coverage), Attendance Record, Evaluation (Internal Assessment) Record, List of Low Performing Students, Value Added Lecture Plan, Internal Practical (Continuous Evaluation) marks for laboratory, Parent Teacher Meeting Record etc.

#### (iii) Each course file shall contain the following:

- Syllabus
- Learning Resources prescribed
- Assignments / Tutorial Sheets
- Current and Previous Class Test / Sessional Question Papers
- Previous Term-End Examination Question Papers
- Lecture Notes (In the Current file only).
- (iv) At the end of the semester, faculty member should submit Teacher Diary and Course File to HODs. HODs shall maintain the record of all course files for at least 5 years.
- (v) Faculty member can withdraw his or her handwritten notes from the course file before submitting to HODs.
- (vi) In case, Faculty member is allotted same subject in the next semester, then he/she can take same course file from Principal / HODs for few days for the reference purpose only.

#### **11. Home Assignments**

a) Home Assignment will be designed as per the final examination pattern as per the details given in the table:



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		No of Questions per Assignment									
		1 Mark	2 Marks	4 Marks		, 6 Marks	10 Marks	12 Marks	Total Marks	Time Per Assignment (Minutes)	Total Time (Hrs.)
		Marks	1	2	4	6	10	12			
S.No.	Examinati on Pattern	No of Assignments	2.5	6	10	15	25	30			
Ymry	Pattern	Two per course / One per two units	10	10	5	3	0	0	68	180	120

b) Minimum one home assignment shall be given from every two units.

# Penalty for late submission of Home Assignment

- a) Every Home Assignment shall have the Date of Release and last Date of Submission.
- b) Penalty for late submission for Home Assignment in the form of %age of marks deduction shall be as under:
  - Within 7 Calendar days: 20%
  - Within 8 to 15 Calendar days: 40%
  - More than 15 Calendar days: 50%
- c) Teachers will ensure that there is no plagiarism in Home Assignment. If plagiarism is detected, a penalty of 30% may be levied and the student will be asked to resubmit the Home Assignment within 7 Calendar days.

# 12. Question Banking and Question Paper Setting for Term End Examination

(i) Question Banking for Term End Evaluation and home assignments shall be done with questions having 1, 2, 4 and 6marks. The time allotted to each question shall be as under: -

Description	Marks							
Description	1	2	4	6				
Term End Examination is	2.5 minutes	5 minutes	10 minutes	15 minutes				
for 60 marks								

(ii) Each question shall be set in the following format: -

S. No.	Question	Marks Allotted	Time Allotted	Bloom Taxonomy (Cognitive Domain) Level	Difficulty Level	Course Outcome Number

(iii) Bloom Taxonomy (Cognitive Domain) levels shall be: Knowledge, Comprehension, Application, Analysis, Evaluation and Synthesis.

(iv) Difficulty levels shall be: Easy, Moderate and Difficult.

- (v) Course Outcome Number shall be the number of specific outcomes given in the Course Objective and Course Outcome Matrix.
- (vi) Term-End Examination question papers shall be set for all courses as per pattern given in the following table:

					Question	Paper Se	tting				
				x		No of Q	Questions	per subj	ect		
			1	2	4	6	10	12	Case		
			Mark	Marks	Marks	Marks	Marks	Marks	Study		Tatal
	u	Marks	1	2	4	6	10	12	40	Maximum	Time
SNO	nati ern	No of								Marks	(mins)
5.110.	ami Patt	Units↓/	2.5	5	10	15	25	30	NA		(mms)
	Ex	Time→									
1	Pattern	4	12	4	4	4	0	0	NA	60	150.0
									L	1	L

# Guidelines

a. Duration of end term theory examination: 3 hours.

b. Maximum marks: 60.

- c. All Questions shall be compulsory.
- d. The Question paper will be divided into four sections A, B, C and D.
- e. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions (2.5 minutes each)
- f. Section B comprises of 4 questions of 2 marks each, one from each unit. (5 minutes each)
- g. Section C Comprises of 4 questions of 4 marks each, one from each unit. (10 minutes each). Each question may have two alternatives, out of which student will be required to attempt one.
- h. Section D Comprises of 4 questions of 6 marks each, one from each unit. (15 minutes each). Each question may have two alternatives, out of which student will be required to attempt one.
- The questions shall be set in such a manner that these cover first five level of Bloom Taxonomy i.e. Knowledge (10-15%), Comprehension (15-25%), Application (15-25%), Analysis (15-25%) and Synthesis (10-15% in normal papers; 50-80% in design papers).
- j. The questions shall have three difficulty level namely Easy, Moderate and Difficult with ratio of 1:2:1 respectively.
- k. Each question will be linked with the relevant CO.

#### 13. Examination Scheme for Mid Semester Question Papers/ Class Test

- (i) Mid Semester Question Papers/ Class Test shall be held normally in 7<sup>th</sup> and 13<sup>th</sup> weeks in the semester. Question papers shall be set from minimum 2 units (50% syllabus of each course). Duration shall be 90 minutes. Maximum marks shall be 30.
- (ii) The structure of the sessional question papers shall remain the same as in term-end examination question paper.

#### 14. Attendance Requirements/Eligibility to Appear in Term End Examination

(i) A student should have minimum 75% attendance in each Course to be eligible to appear in Term End Examination failing which she/he shall be detained from appearing in the Term End Examination of that particular Course. A maximum



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condonation to the extent of 10% may be granted by the Dean of Faculty of Science based upon genuine reasons such as hospitalization of self / parents / siblings, death in the family, participation in University sponsored activities outside the University campus and voluntary blood donation etc.

- (ii) It will be the responsibility of the student to keep a track of her/his attendance in each Course in an Academic Term (semester) through ERP Portal and / or Course Teacher.
- (iii) If a student is detained in a particular case, she/he shall be required to make-up the deficiency of attendance in the subsequent Academic Terms by attending classes, appearing in class tests and submitting additional home assignments. Once such student has made-up the deficiency, she/he will be allowed to appear in the next supplementary examination.
- (iv) If the deficiency is more than 25% in a particular Course (having less than 50% attendance), the student will be required to pay additional fee specified by the university time to time for attending the classes again for which she/he will have to register for the Course(s) again in the subsequent term with the approval of the HOD/Dean concerned.

#### **15. Term End Examination Rules**

- i. The Term End examination for all semesters shall ordinarily be held in the month of December and May/June for all regular and reappear candidates. The examination dates are fixed by the Controller of Examination with the approval of Vice Chancellor.
- ii. Examination Rules including appointment of Examiners, Evaluation of answer sheets, compilation of results, calculation of SGPA/CGPA etc. shall be notified separately.
- iii. Answer sheets for the Term End Examination shall be shown to the Examinees before compilation of result by the Faculty members as per schedule (normally in two parts) notified by Head of the Department concerned in consultation with the Controller of Examination.
- iv. Normally the schedule for showing answer sheets to the examinees shall be so prepared that they are shown bulk of the answer sheets before last regular examination. Answer sheets related to last two/three exams can be shown within a week from the last date of examination.

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- v. If a student raises objection to the award of marks in a particular answer sheet, the same shall be considered by a Committee of two Faculty members appointed by Head of the Department and settled on the same day with the approval of Head of the Department concerned.
- vi. No request for re-evaluation of answer sheets shall be entertained after the declaration of results.

#### 16. Project / Dissertation

- i. Topic Selection and Appointment of Guide/Supervisor: Normally selection of project topic / research problem shall be finalized in the previous Semester. HOD concerned shall call applications for allotment of project topic / research problem from the students minimum six weeks before the last date of classes in the previous Semester along with a detailed proposal in the specified format.
- ii. HOD concerned shall constitute a Committee for allotment of project topic / research problem for dissertation consisting of minimum 3 Faculty members. The Committee will interview each student and submit the proposed project topic/research problem for each student along-with the suitable Project / Research Supervisor name. HOD shall approve the recommendation of the committee after satisfying herself/himself about the project topic, research problem and the recommended Supervisor. In case, a Project requires a team activity in an undergraduate program, project team shall not have more-than 3 members and role of each team member shall be well defined.
- iii. Student shall start working on the literature review in the previous Semester itself and start the project / research activities right from day-1 of the Academic Term in which the Project / Dissertation is included in the Scheme of Study.
- iv. It will be mandatory for each student to publish/write at-least one review / research paper in SCOPUS / Web of Science indexed Journal to become eligible for the award of postgraduate degree. For the purpose of eligibility for the award of degree acceptance by the Journal will be sufficient.
- v. Each student/team, as the case may be, shall submit minimum 3 copies of Project Report/ Dissertation in the specified format.
- vi. Evaluation of Project/ Dissertation: A project/ dissertation undertaken by students shall be evaluated by a panel consisting of one external and one internal examiner.



External examiner shall be appointed by the Dean of Faculty concerned out of the panel approved by the Vice Chancellor.

#### 17. Internship / Field Training

The duration of the Internship will be 4 weeks of 4 credits. The formative and summative assessment marks are mentioned in the scheme of study. The final viva voce and reports will be adjudged by the joint Board of External and/or Internal Examiners.

#### **18. Setting of Question Papers:**

- i. The Head of the Department/Dean of the Faculty shall supply the panel of internal and external examiners duly approved by the Board of Studies to the Controller of Examinations. The paper(s) will be set by the examiner(s) nominated by the Vice-Chancellor from the panel of examiners.
- ii. An examiner shall be allowed to set not more than two papers in a semester examination.
- iii. The examiner(s) will set the question papers as per criteria laid down in the Scheme of Examinations as approved by the Board of Studies/Academic Council of the University.

#### **19. Evaluation Process – Theory and Practical:**

#### i. Evaluation of Answer Books:

The answer books may be evaluated either by the paper setter or any other internal or external examiner to be nominated by the Controller of Examiners with the approval of the Vice-Chancellor from the panel of examiners approved by the Board of Studies.

#### ii. Fail/ Reappear candidates:

Fail / Re-appear (Internal/External) candidate of any semester may appear in the reappear exams, as an ex-student, during any term end exams of his/her remaining semesters and up to two years after his final semester as per N+2 rule.

#### iii. Practical Examinations - Appointment of Examiner:

The practical examinations shall be conducted by a Board of two Examiners consisting of one internal and one external examiner to be nominated by the Vice-Chancellor from the panel of examiners.

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#### iv. Marks Distribution:

The distribution of marks in examination of the practical course will be as per the criteria given below:

- a. Demonstration/Conduct/Presentation = 50% marks
- b. Viva-Voce Examination = 50% marks

#### 20. Evaluation and Gradation Criteria

Evaluation and Gradation Criteria for Continuous / Formative Assessment and Term End / Summative Assessment shall be followed as mention below:

- (i) Minimum pass percentage will be 40% for Continuous/Formative Assessment and 40% for Term End/Summative Assessment respectively in all Theory/Practical Courses, making overall minimum pass percentage to be 40%.
- (ii) If a student fails to obtain minimum 40% marks in Continuous/Formative Assessment in a Theory paper, he/she will be required to improve the same by appearing in additional class tests and submitting additional assignments before the close of the Academic term. Such students will be allowed to appear in the Term End Examination of that particular Course provided he/she meets the minimum attendance criteria. However, If a student fails to meet the minimum requirement of 40% marks in Continuous/Formative Assessment before the Term End Exams, his/her result in that course will be shown as RL (FCA), in which case he/she will be required to obtain minimum 40% marks in Continuous/Formative Assessment by appearing in additional class tests and submitting additional assignments in subsequent terms.
- (iii) The Letter and Numerical Grades for different range of percentage of marks obtained in Continuous and Term End Assessment together in a particular Course shall be as under:-

Percentage of Marks Obtained	Letter Grade	Numerical Grade	Performance Level
90% and above	0	10	Outstanding
80% and above but less than 90%	A+	9	Excellent

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70% and above but less than 80%	А	8	Very Good
60% and above but less than 70%	B+	7	Good
50% and above but less than 60%	В	6	Above Average
Above 40% but less than 50%	С	5	Average
Minimum Pass Marks 40%	D	4	Pass
Below 40%	F	0	Fail

- (iv) If it is required to calculate the percentage of marks obtained by a student for the entire Program, the same will be calculated by multiplying overall CGPA with a factor of 10.
  - (v) Grace marks of maximum 1% of the Theory courses may be permitted in a particular Semester.

# 21. Declaration of Results:

- i. The Controller of Examinations shall declare the results as early as possible after the conclusion of each examination, but before the start of teaching for the next academic session.
- Each successful student/ the student placed in reappear shall receive a copy of the Detailed Marks Certificate/ Grade Card Sheet of each semester examination.
- iii. The student whose result is declared late without any fault on his/her part may attend classes for the next higher semester provisionally at his /her own risk and responsibility, subject to his /her passing the concerned semester examination. In case, the student fails to pass the concerned semester examination, his/her attendance/internal assessment in the next higher semester in which he / she was allowed to attend classes provisionally will stand cancelled.

#### 22. Criteria for Promotion to Higher Semester(s):

All students shall be promoted to the next semester / year irrespective of the number of papers cleared/passed in the lower semesters.

23. Improvement of Division after the award of Degree

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- (i) A student may re-appear for improvement in not more than 5 theory papers only after award of degree within one year from the date of declaration of result of the last / final examination to improve his/her Division after depositing the prescribed Examination Fee as notified by the University from time to time.
- (ii) In the case of re-appearance in paper, the result will be prepared on the basis of the candidate's best performance in either of the Examination.

#### 24. Striking off the name of the defaulting students from the rolls of the University

- (i) If a student remains absent for a continuous period of seven working days without written authorization from the Head of the Department of concerned, her/his name shall be struck off from the rolls of the University. However, such students may be re-admitted on payment of the Re-admission fee as prescribed by the University from time to time; if Dean/Principal is satisfied that re-admission of the student will not fall short of requisite percentage of the attendance.
- (ii) If a student fails to pay fees by the last cut of date as prescribed by the University from time to time, her/his name shall be struck off from the rolls of the University. However, such students may be re-admitted on payment of the Re-admission fee as prescribed by the University from time to time; if Dean/Principal is satisfied that readmission of the student will not fall short of requisite percentage of the attendance.
- (iii) If a student is re-admitted, all his previous records shall be revived under the current structure, regulations and schedule of fees.

# **25. Other Provisions:**

- Nothing in the Ordinance shall debar the University from amending the Ordinance and the same shall be applicable to all the students whether old or new.
- ii. Any other provision not contained in the Ordinance shall be governed by the rules and regulations framed by the University from time to time.
- iii. In case of any dispute, the Vice-Chancellor will be competent authority to interpret the rules and his interpretation shall be final.

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# M.Sc.(Chemistry) Syllabus (2020-21) Program Structure under Choice Based Credit System (CBCS)

SEMESTER	COURSE CODE	COURSENAME	L	Т	Р	Contact hours/ week	Credits	Max. Marks	Formative Assessment	Summativ Assessmen
	Core Courses	(cc)		_						
	17060101	Transition Metal Chemistry	3	0	0	3	3	100	40	60
	17060102	Quantum Chemistry and Thermodynamics	3	0	0	3	3	100	40	60
	17060103	Stereo Chemistry and Organic Reaction Mechanism	3	0	0	3	3	100	40	60
I	17060104	Inorganic Chemistry Practical-I	0	0	4	4	2	100	60	40
	17060105	Physical Chemistry Practical-I	0	0	4	4	2	100	60	40
	170601006	Organic Chemistry Practical-I	0	0	4	4	2	100	60	40
	Ability Enhand	cement Compulsory Course (AECC)								
	17060107	Professional Ethics and Human Values	2	0	0	2	2	100	40	60
	Skill Enhance	Course								
	17060108	Analytical Chemistry	2	0	0	2	2	100	40	60
Fotal Credits			13	0	12	25	19	800	380	420
	Core Courses									
	17060201	Bioinorganic Chemistry and Metal Clusters	3	0	0	3	3	100	40	60
	17060202	Chemical Kinetics and Electro Chemistry	3	0	0	3	3	100	40	60
	17060203	Organic Spectroscopy	3	0	0	3	3	100	40	60
ш	17060204	Inorganic Chemistry Practical-II	0	0	4	4	2	100	60	40
	17060205	Physical Chemistry Practical-II	0	0	4	4	2	100	60	40
	17060206	Organic Chemistry Practical-II	0	0	4	4	2	100	60	40
	Ability Enhand	cement Compulsory Course (AECC)								
	17060207	Research Methodology and Technical Writing	2	0	0	2	2	100	40	60
	Skill Enhancer	ment Course								
	17060208	Material Chemistry	2	0	0	2	2	100	40	60
<b>Fotal Credits</b>			13	0	12	25	19	800	380	420
	17060209	Summer Training(4 weeks)	-	-	-	-	4	200	100	100
				Sp	ecializ	ation			1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	
	Discipline Spec	cific Elective Courses(DSEC)								
	XXXXXXXX	DSEC – 1	3	0	0	3	3	100	40	60
	xxxxxxxx	DSEC – 2	3	0	0	3	3	100	40	60
	xxxxxxxx	DSEC – 3	3	0	0	3	3	100	40	60
	xxxxxxxx	DSEC – 1 Lab	0	0	4	4	2	100	60	40
	xxxxxxxx	DSEC – 2 Lab	0	0	4	4	2	100	60	40
III		DSEC – 3 Lab	0	0	4	4	2	100	60	40
	Skill Enhance	ment Course (SEC-3) (Common for all the	specia	lizati	ons)			1		
	17060319	Drug Design and Development	2	0	0	2	2	100	40	60
	Open Elective	Course ( From University Basket)(Commo	n for a	ull the	specia	lizations)				
	17060320	OEC	3	0	0	3	3	100	40	60
<b>Fotal Credits</b>			14	0	12	26	20	800	380	420
		1						000		

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	1.1	Grand Total	40	0	56	96	82	3000	1440	1560
<b>Total Credits</b>			0	0	20	20	20	400	200	200
IV	17060401	* Project Work	0	0	20	20	20	400	200	200

**\*Project Work**: The project work may be carried out at in-house labs or some outside agency having required facilities for the specified work. On successful completion of the project, every candidate has to submit a final dissertation/report to their concerned department.

Semester (Credits)	Core Courses	DSE Courses	SE Courses	AEC Courses	Research Training	Open Elective	Total
Ι	15	-	2	2	-	-	19
П	15	-	2	2	-		19
III		15	2	-	-	3	20
IV	-		-	-	20	-	20
Total	30	15	6	4	20	3	78
				Summer Tra	ining (4/6 Weeks) after	second semester	04
			Online c	ourses from N	AOOC (Sem – I to Sem	– III) Maximum	09
						Grand Total	91
				Mini	mum Credits for av	vard of degree	82

Category	Credits	%
Core Course(CC)	30	40%
Discipline Specific Elective Course(DSEC)	15	17%
Skill Enhancement Course (SEC)	6	7%
Ability Enhancement Compulsory Course (AECC)	4	4%
Research Training	20	22%
Open Elective	3	3%
Summer Training after second semester	4	4%
Online courses from SWYAM (Sem - I to Sem - III)	9	10%
Total	91	

×.	Discipline Specific Elective Courses(DSEC)							
S.No Course Code Course Name								
	Spe	cialization: Inorganic Chemistry						
1 17060301 Advanced Inorganic Spectroscopy		Advanced Inorganic Spectroscopy						
2	17060302	Coordination Chemistry						
3	17060303	Organometallic Chemistry						
4	17060304	Inorganic Special Practical-I						
5 17060305 Inorganic Special Practical-II								
6 17060306 Inorganic Special Practical-III								

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1.1		Specialization: Physical Chemistry				
7	17060307	Chemical Dynamics and Surface Chemistry				
8	17060308	Advance Quantum Chemistry and Statistical Thermodynamics				
9	17060309	60309 Solid State and Biophysical Chemistry				
10	10 17060310 Physical Special Practical-I					
11	17060311	311 Physical Special Practical-II				
12	17060312 Physical Special Practical-III					
		Specialization: Organic Chemistry				
13	17060313	Photo Chemistry and Pericyclic Reactions				
14	17060314	Heterocyclic Chemistry and Organic Synthesis				
15	17060315	Reagents and Rearrangements				
16	17060316	Organic Special Practical-I				
17	17060317	Organic Special Practical-II				
18	17060318	Organic Special Practical-III				

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						Nar	ne o	fthe	5 Fa	cult	H	acult	ty of	Sci	enc															
					-	Name	oft	10 P	rog	ram	SM:	30 (0	hen	nistr	y) 2	021				-										
	_							-	-	F	rieory	-	heory	(Inter	(Jul)	-	P	actica	-	_	•	ractic	al (Inte	rnal)		_				
Sr.N	S. ≺	nester/ fear	Course Code	Nomenclature	Theory/ Practical	Corel BSEC Corel C	٦	1	P Credits	xeM		Midterm	tnəmngizzA	Professional Activities	XBM	Demonstration/Contentation		xeM	Pass	Attendance & Regularity in Lab Work	Project/Laboratory Work Report	InemeseseAlnoitsnimex3 IsnO mothin	Conduct/Demonstration	xsM	ssed	Overall Maximum Marks	Overall Pass Marks	Whether to be offered CBCS (Yes/No)	Scheme of Examir Scheme of Examir (Theory+Internal+P - Oral/Theory +Internal+Practi	nations rractical / ical/ cal
					-	SSIGNED	MARK	s		60	24	20	9	10	10	6 2	й 0	4	÷	9	9	9	30	99	24					
-		-	17060101	Transition Metal Chemistry	Theory	Core	e	0	0	60	24	20	10	10	40	9	-		-							100	40	No	Theory+Internal	
~			17060102	Quantum Chemistry and Thermodynamics	Theory	Core	0	0	0	60	24	20	9	10	40	9	-		-						-	100	40	No	Theory+Internal	
3		1-	17060103	Stereo Chemistry and Organic Reaction Mechanism	Theory	Core	3	0	0	60	24	20	10	10	10	9	-	-	-						-	100	40	No	Theory+Internal	
4			17060104	Inorganic Chemistry Practical-I	Practical	Core	0	0	4				1		-	2	0	4	9	19	10	10	30	60	24	100	40	No	Practical +Internal	
2		2	17060105	Physical Chemistry Practical-I	Practical	Core	0	0	4	-				-	-	2	0 20	4	19	10	9	9	3	8	24	100	4	No	Practical +Internal	
9		-	17060106	Organic Chemistry Practical-I	Practical	Core	0	0	4					-	-	N	0 50	4	16	10	10	10	30	60	24	100	40	No	Practical +Internal	
7		-	17060107	Professional Ethics and Human Values	Theory	AECC	2	0	0	60	24	20	10	10 4	10	9	-		-			-			-	100	40	No	Theory+Internal	
80		-	17060108	Analytical Chemistry	Theory	SEC	2	0	0	60	24	20	10	10	10	9	-	-							-	100	40	No	Theory+Internal	
6			17060201	Bioinorganic Chemistry and Metal Clusters	Theory	Core	m	0	0	60	24	20	9	10	10	9	-	-	-			1.4		_	-	100	40	No	Theory+Internal	
10			17060202 (	Chemical Kinetics and Electro Chemistry	Theory	Core	0	0	0	60	24	20	10	10 4	10	9	-	-	-							100	40	N	Theory+Internal	
11			17060203	Organic Spectroscopy	Theory	Core	m	0	0	60	24	20	9	10 4	10	9			-						_	100	40	۶	Theory+Internal	
12		5	17060204 1	Inorganic Chemistry Practical-II	Practical	Core	0	0	4							2	0 20	4	10	10	9	9	30	8	24	100	40	Ŷ	Practical +Internal	
13		1	17060205	Physical Chemistry Practical-II	Practical	Core	0	0	4						-	20	0 20	4	16	10	9	10	30	60	24	100	40	No	Practical +Internal	
14			17060206	Organic Chemistry Practical-II	Practical	Core	0	0	4						-	2(	0 20	40	16	5 10	10	10	30	60	24	100	40	No	Practical +Internal	
15			17060207	Research Methodology and Technical Writing	Theory	AECC	2	0	0	60	24	20	10	10 4	10	9		-	_	_						100	40	No	Theory+Internal	
16			17060208	Material Chemistry	Theory	SEC	2	0	0 2	60	24	20	10	10 4	10	9										100	40	No	Theory+Internal	
17			17060209	Summer Training	Practical		0	0	0 4						-	4(	40	80	32	20	20	20	60	120	48	200	80	N	Practical +Internal	
48			17060301	Advanced Inorganic Spectroscopy	Theory	DSEC	е	0	0	99	24	20	10	10 4	10	9	_									100	40	No	Theory+Internal	
19			17060302	Coordination Chemistry	Theory	DSEC	3	0	0	60	24	20	10	10 4	10 11	9	-									100	40	No	Theory+Internal	
20			17060303	Organometallic Chemistry	Theory	DSEC	б	0	0 3	60	24	20	10	10 4	10 11	9				-						100	40	No	Theory+Internal	
21			17060304	Inorganic Special Practical-I	Practical	DSEC	0	0	4 2							2(	0 20	40	16	10	10	10	30	60	24	100	40	Ñ	Practical +Internal	
22			17060305	Inorganic Special Practical-II	Practical	DSEC	0	0	4							2(	0 50	40	16	10	10	10	30	99	24	100	40	No.	Practical +Internal	
23			17060306	Inorganic Special Practical-III	Practical	DSEC	0	0	4 2							2(	0 20	40	16	10	10	10	30	60	24	100	40	No	Practical +Internal	
24			17060307	Chemical Dynamics and Surface Chemistry	Theory	DSEC	3	0	0	60	24	20	10	10 4	10	9	-									100	40	N	Theory+Internal	
25			17060308	Advance Quantum Chemistry and Statistical Thermodynamics	Theory	DSEC	б	0	0	60	24	20	10	10 4	10 1	9		-					1			100	40	°N	Theory+Internal	
26			17060309	Solid State and Biophysical Chemistry	Theory	DSEC	3	0	0	60	24	20	10	10 4	10	9	-									100	40	No.	Theory+Internal	
27	=	IVI	17060310	Physical Special Practical-I	Practical	DSEC	0	0	4							2(	0 20	40	16	10	9	10	30	80	24	100	40	No.	Practical +Internal	
28			17060311	Physical Special Practical-II	Practical	DSEC	0	0	4						-	2(	0 20	40	16	10	10	10	30	60	24	100	40	No	Practical +Internal	
29			17060312	Physical Special Practical-III	Practical	DSEC	0	0	4							2(	20	40	16	10	9	10	8	99	24	100	40	No	Practical +Internal	
30			17060313	Photo Chemistry and Pericyclic Reactions	Theory	DSEC	3	0	0	60	24	20	9	10 4	10	9	-	_	_						_	100	40	No	Theory+Internal	
31			17060314	Heterocyclic Chemistry and Organic Synthesis	Theory	DSEC	3	0	0	60	24	20	9	10 4	10	9	-	_	_							100	40	No.	Theory+Internal	
32			17060315	Reagents and Rearrangements	Theory	DSEC	3	0	0	60	24	20	9	10 4	10	9	_		_							100	40	No	Theory+Internal	
33	_		17060316 (	Organic Special Practical-I	Practical	DSEC	0	0	4					-	-	2(	0 20	40	16	10	9	10	30	60	24	100	40	No	Practical +Internal	

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	17060317	Organic Special Practical-II			Practical	DSEC	0	0	4	01						20	20	40	16	10	10	10	30	60	24 1	00 40	Ŷ	Practical +Internal
	17060318	Organic Special Practical-III			Practical	DSEC	0	0	4	0					-	20	20	40	16	10	10	10	30	60	24 1	00 40	g	Practical +Internal
	17060319	Drug Design and Developmen	Ħ		Theory	SEC	2	0	0	9	0 24	20	10	10	40	9									11	00 40	8 N	Theory+Internal
	17060320	Open Elective Course ( From L	University Bas	ket)	Theory	OEC	0	0	0	90	24	20	9	10	40	9						-			1	00 40	Ŷ	Theory+Internal
IV/II	17060401	Project Work			Practical		0	0	0	0					-	80	80	160	64	40	40	40	120	240	96 4	00 160	No	Practical+Internal
4		Online Courses during 1st, 2	Ind and 3rd s	emesters*					-						-							-						

course- 3 credits	
12 weeks c	1
2 credits, 1	Ter:
course-	opt for eith
lit, 8 weel	ent may o
se-1 creo	ter a stud
veek cour	ery semes
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Every semiester a suutent may option entiter.	One, 12 week course or	One, 4 week course & One, 8 week course or	Three, 4 week courses

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# Department of Chemistry MSc (Chemistry) Syllabus and curriculum (2020-21) Program Structure under Choice Based Credit System (CBCS)

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1. Name of the Dep	artment	: Chemis	stry					
2. Course Name	-	Transiti	on Meta	l Chemis	stry	L	Т	Р
3. Course Code		170601	01			3	0	0
4. Type of Course (use tick mark)				Сог	re (🖌	D	SE ()	SEC ()
5.Pre-requisite (if any)	B.Sc. (F Chemis B.Sc. (N Medical al)	Hons) try or Non I/Medic	6. Freque (us ma	ency e tick rks)	Even ()	Odd (🛩	Either Sem ()	Every Sem ()
7. Total Number of I	Lectures,	, Tutoria	ls, Prac	ticals				
Lectures = 40			Tutori	als = Ni		Pract	ical = Nil	
8. Course Description	n:							
<ul> <li>In transition metal ch formation constants a Students will also be</li> <li>9. Course Objectives</li> <li>9. Course Objectives</li> <li>The objectives of this</li> <li>1. To provide a firm</li> <li>2. To introduce the formation of inorg</li> <li>3. To explain the con</li> <li>4. To introduce impo</li> <li>10. Course Outcome</li> <li>Upon successful comp</li> <li>1. Demonstrate the k</li> <li>2. Identify and solve</li> <li>3. Apply the analytic</li> <li>4. Explain the struct</li> </ul>	emistry. I and their made fam s: course an foundatic concept anic com acept of d ortance & s (COs): pletion of cnowledge the probi- cal reason ures and p	It covers interaction interaction interaction re: on in trans of stepw plexes. ifferent n amp; app this cours e of trans lems rela- ing for e: properties	the inor, ons as we netal c sition me vise and nechanis lications rse, the s sition me ted to th xplainin s of diffe	ganic rea ell as fa clusters. etal chen overall ms for the of isopo- student we etal chem e format g the me erent met	nistry. formation co bly and hetero vill be able to: istry. ion of inorgan chanisms of li al clusters and	isms with s g stability of onstants an of inorganic poly acids a ic complex gand displa I transition	d their us complexe and metal es. acement re metal-com	nd overall omplexes. ses in the es clusters.
11. Unit wise detaile	d content	t					incui con	ipienes
Unit-1 Nu	imber of	lectures	= 12	Title o Solutio	of the unit: n	Metal-Lig	and Equ	ilibria in
Bent rule and determine and their interactions with reference to the r	nation of , Trends nature of	energetion in stepw metal ion	cs of hyl ise cons and liga	bridizatio tants, Fa and, Che	on, Stepwise a ctors affecting late effect and	nd overall g stability l its thermo	formation of metal c dynamic c	constants complexes origin.
Unit – 2 Nu	imber of	lectures	= 8	Title Transi	of the unit tion Metal Co	: Reactio	n Mecha	anism of
Inert and labile comp	lexes, M	echanism	is for lig	and repl	acement react	tions, Form	nation of c	omplexes
Astance	Ø		6	/,	Apri	~ 1	V	÷

of aquo ions, Ligand displacement reactions in octahedral complexes- acid hydrolysis, base hydrolysis.

Unit – 3	Number of lectures = 12	Title of the unit: Reaction Mechanism of Transition Metal Complexes II						
Mechanism of liga	nd displacement reactions in	square planar complexes. Trans effect. Theories of						
trans effect Mech	anism of electron transfer	reactions - types: Outer sphere electron transfer						
mechanism and inn	er sphere electron transfer m	echanism Electron exchange						
Unit $-4$	Number of lectures - 8	Title of the unit: Isonaly and hotoronaly Aside						
Umi – 4	Number of fectures – 8	and metal clusters						
Isonoly and Hetero	poly acids and salts of Mo an	and initial clusters						
Metal Clusters: S	tructure and bonding in high	ar horanes. Wade's rules. Carboranes						
12. Brief Descripti	on of self learning / E-learn	ing component						
		ing component						
1. http://textofvid	leo.nptel.ac.in/104105033/leo	:39.pdf.						
2. http://nptel.ac.	in/courses/104101006/downl	oads/lecture-notes/mod10/lec3.pdf						
3. https://ocw.mit	t.edu/courses/chemistry/5-11	1sc-principles-of-chemical-science-fall-2014/unit-ii-						
chemical-bond	ing-structure/lecture-12/							
4. https://www.yo	outube.com/watch?v=1jRo5f	Tg0KY						
5. http://web.mit.	edu/5.03/www/readings/poly	hedral boranes/006 cluster bonding.pdf						
6. http://www.ma	college.in/app/webroot/uploa	ads/department materials/doc 560.doc.						
13. Books Recomm	nended							
1. Selected Topic	s in Inorganic Chemistry, N	Malik, Tuli and Madan, New Delhi : S. Chand &						
Company Ltd, I	<b>SBN-13</b> : 978-8121906005							
2. Inorganic Chem	nistry, T. Moeller, Wiley; 2nd	edition, ISBN-13: 978-0471612155						
3. Modern Aspects of Inorganic Chemistry, H.J. Emeleus and A.G. Sharpe, Routledge & Kegan								
Paul PLC; Revi	sed ed edition, Routledge and	d kegan paul PLC ISBN-13: 978-0710075215						
4. Chemical Bindi 818847603X.	ng by O.P. Agarwal, Disha	Publication; Second edition ISBN: 9788188476039,						
5. Inorganic React	ion Mechanism by Edberg, y	ol. 70. 1st edition. ISBN: 9780128128343						
6. Mechanism of 1 978-047105545	Inorganic reaction by F. Base	olo R.G. Pearson, John Wiley & Sons Inc, ISBN-13:						
7. Structural Prin	ciples in Inorganic Compo	ound, W.E.A. Addison, Longmans, ISBN-13: 978-						
9 Advanced In	conia Chamister her Catt	d Willingen A Wile Liter in her st						
6. Advanced morg	$3 \cdot 0.78  0.471100571$	in winkinson, A whey-interscience publication, 5th						
Ealuon ISBN-I	3: 978-04/11995/1							
9. Fundamental C	oncepts in morganic Chen	nistry, vol. 2, Asim Das and Manua Das, CBS						
Publishers & Di	Istributors Pvt Ltd, India; Ist	eatton <b>ISBN-13:</b> 978-8123923512						
10. Inorganic Chen	L Kaitan Oldilk Mallin	ire and Reactivity by James E. Huheey, Ellen A.						
11 Lange Chara	L. Keiter, Oknil K. Medni, P	rentice Hall; 4 edition, <b>ISBN-13:</b> 9/8-0060429959						
11. Inorganic Chem	istry by Shriver and Atkins,(	Dxford; 5 edition ISBN-13: 9/8-0199236176						
12. Polyoxometalat	e Molecular Science by	Juan J. Borras-Almenar, Eugenio Coronado,						
Achim Muller	and Michael Pope, <u>NATO</u>	Science Series, (NAII, volume 98), ISBN 978-						
1402012426								
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	Quantum Mechan	nics and Thermodynam	ics	L	T	P
3. Course Code	17060102			3	0	0
4. Type of Course	(use tick mark)	Core (✔)	DS	E ()	SE	EC ()
5. Pre-requisite	B.Sc. (Hons)	6. Frequency	Even	Odd	Either	Every
(if any)	Chemistry or	(use tick marks)	0	$( \mathbf{A} )$	Sem ()	Sem (
	B.Sc. (Non					
	Medical/Medic					
	al)					
7. Total Number	of Lectures, Tutor	rials, Practicals				
Lectures = 40		Tutorials = Nil	Pr	actical =	= Nil	Art
8. Course Descrip	ption:					
This course will er	hable the post grad	luate students to under	stand an	nd ratio	nalize the	basics a
idvancement of qua	intum chemistry, in	cludes the Schrodinger	wave eq	quation	for 1-D, 2-	D and 3
long with the opera	tors and other impo	rtant aspects of quantum	1 chemis	try. Stud	dents will a	lso focu
on the interesting co	ncepts of thermody	namics such as theirs la	ws, phas	se rule, t	fugacity.	
9. Course Object	tives:					
The objectives of the	is course are:					
1. To provide a firm	m foundation in the	fundamentals and appli	cations	of quant	um mechai	nics
2. To learn degene	racy in 3-D box, si	mple harmonic oscillato	or and rig	gid rotat	or	
3. To introduce the	importance & appl	lication of first & second	d law of	thermod	lynamics	
4. To explain the in	mportance & applic	ation of Phase Rule, Pha	ase diag	ram.		
10. Course Outcor	nes (COs):	n an an Araba an Arab				
Jpon successful cor	npletion of this cou	rse, the students will be	able to:			
. Understand the	various concepts of	quantum mechanics &	wave m	echanics	5	
Explain the deg	eneracy in 3-D box	simple harmonic oscill	ator and	rigid ro	tator	
B. Solve the proble	ems related to first	& second law of thermo	dynamic	s	utor	
<ol> <li>Describe system</li> </ol>	ns of one componer	t as well as multi-comp	onent sv	stems.		
1. Unit wise detail	ed content					
	Number	Title of the unit: Oua	ntum M	lechani	cs-I	
Jnit-1	Number of					
Unit-1	lectures = 12	<b>X</b>				
U <b>nit-1</b> Postulates of Quantu	lectures = 12 Im Mechanics; Schi	odinger wave equation;	Max-Bo	orn inter	pretation o	fΨ and t
Unit-1 Postulates of Quantu Heisenberg's unce	lectures = 12 im Mechanics; Schr rtainty principle;	odinger wave equation; Operators and their	Max-Bo algeb	orn inter ra ,Lin	pretation of the second s	fΨ and Hermit
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo	In Mechanics; Schurtainty principle; mentum and angula	odinger wave equation; Operators and their ar momentum operators	Max-Bo algeb as Herr	orn inter ra ,Lin nitian o	pretation of ear and perators), o	fΨand Hermit
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators.	im Mechanics; Schr rtainty principle; mentum and angul	odinger wave equation; Operators and their ar momentum operators	Max-Bo algeb as Herr	orn inter ra ,Lin nitian o	pretation of lear and perators), o	fΨ and Hermit commuti
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave ec	In Mechanics; Schr rtainty principle; mentum and angul	odinger wave equation; Operators and their ar momentum operators e in one, two and three d	Max-Bo algeb as Herr	orn inter ra ,Lin nitian o nal box;	pretation of lear and perators), of evaluation	fΨ and Hermit commution
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave ecosition, average mo	In Mechanics; Schr rtainty principle; mentum and angul quation for a particle omentum and deter	odinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty	Max-Bo algeb as Herr imension in posit	orn inter ra ,Lin mitian o nal box; ion and	pretation of ear and perators), of evaluation momentur	fΨ and Hermit commuti of avera n, pictor
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave eco position, average mo epresentation of the	In Mechanics; Schr rtainty principle; mentum and angul quation for a particle omentum and deter e wave equation of	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty f a particle in one dime	Max-Bo algeb as Herr imension in posit	orn inter ra ,Lin nitian o nal box; ion and box and	pretation of lear and perators), of evaluation momentur d its influe	fΨ and Hermiticommution of avera n, pictor nce on t
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave ecosition, average mo epresentation of the cinetic energy of the	In Mechanics; Schr rtainty principle; mentum and angul quation for a particle omentum and deter e wave equation of particle in each su	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty f a particle in one dime ccessive quantum level,	Max-Bo algeb as Herr imension in posit ensional concept	orn inter ra ,Lin nitian o nal box; ion and box and of zero	pretation of lear and perators), of evaluation momentur d its influe point energi	fΨ and Hermit commution of avera n, pictor nce on gy.
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave ec position, average mo representation of the cinetic energy of the Unit – 2	In Mechanics; Schurtainty principle; mentum and angula quation for a particle omentum and deter e wave equation of particle in each su Number of	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty f a particle in one dime ccessive quantum level, <b>Title of the Unit: Qua</b>	Max-Bo algeb as Herr imension in posit ensional concept	orn inter ra ,Lin nitian o nal box; ion and box and of zero <b>Iechani</b>	pretation of ear and perators), of evaluation momentur d its influe point energi	fΨ and Hermit commution of avera n, pictor nce on gy.
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave eco position, average mo representation of the cinetic energy of the Unit – 2	In Mechanics; Schr rtainty principle; mentum and angul quation for a particle omentum and deter wave equation of particle in each su Number of lectures = 8	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty a particle in one dime ccessive quantum level, <b>Title of the Unit: Qua</b>	Max-Bo algeb as Herr imension in posit ensional concept intum N	orn inter ra ,Lin nitian o nal box; ion and box and of zero <b>Iechani</b>	pretation of lear and perators), of evaluation momentur d its influe point energi cs-II	fΨ and Hermit commution of avera n, pictor nce on to gy.
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave ecosition, average mo representation of the cinetic energy of the Unit – 2	Intervention         lectures = 12         im Mechanics; Schir         rtainty principle;         mentum and angular         quation for a particle         omentum and deter         e wave equation of         particle in each sur         Number of         lectures = 8         neracy among ener	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty f a particle in one dime ccessive quantum level, <b>Title of the Unit: Qua</b> gy levels for a particle i	Max-Bo algeb as Herr imension in posit concept <b>intum M</b> n three o	orn inter ra ,Lin nitian o nal box; ion and box and of zero <b>Iechani</b> limensio	pretation o lear and perators), o evaluation momentur d its influe point energing cs-II	fΨ and Hermit commution of avera n, pictor nce on gy.
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave ec position, average mo representation of the cinetic energy of the Unit – 2 The concept of dege vave equation for a l	Number of         lectures = 12         um Mechanics; Schurtainty principle;         mentum and angula         quation for a particle         omentum and deter         e wave equation of         particle in each su         Number of         lectures = 8         neracy among ener         inear harmonic osc	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty f a particle in one dime ccessive quantum level, <b>Title of the Unit: Qua</b> gy levels for a particle i illator & its solution by p	Max-Bo algeb as Hern imension in posit ensional concept <b>ontum M</b> n three coolynom	orn inter ra ,Lin nitian o nal box; ion and box and of zero <b>Iechani</b> limensio ial meth	pretation of lear and perators), of evaluation momentur d its influe point energi cs-II	fΨ and Hermiticommuticommutic of avera n, pictor nce on to gy.
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave ecosition, average mo representation of the cinetic energy of the Unit – 2 The concept of dege wave equation for a lost a particle possess	Intervention	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty a particle in one dime ccessive quantum level, <b>Title of the Unit: Qua</b> gy levels for a particle i illator & its solution by p on and its consequence.	Max-Bo algeb as Herr imension in posit ensional concept <b>intum N</b> n three of polynom Schrodi	orn inter ra ,Lin nitian o nal box; ion and box and of zero <b>Iechani</b> limensio ial meth nger wa	pretation of lear and perators), of evaluation momentur d its influe point energing cs-II onal box. S nod. Zero point equation	fΨ and Hermit commution of averation, pictor nce on the gy.
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave ecosition, average mo epresentation of the cinetic energy of the Unit – 2 The concept of dege vave equation for a lo of a particle possess limensional Rigid re	Number of         lectures = 12         um Mechanics; Schurtainty principle;         mentum and angular         quation for a particle         omentum and deter         e wave equation of         particle in each sur         Number of         lectures = 8         neracy among ener         inear harmonic osc         ing harmonic motio         otator, energy of rig	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty f a particle in one dime ccessive quantum level, <b>Title of the Unit: Qua</b> gy levels for a particle i illator & its solution by p on and its consequence. id rotator, space quantiz	Max-Bo algeb as Herr imension in posit ensional concept <b>intum M</b> n three of polynom Schrodi cation; S	orn inter ra ,Lin nitian o nal box; ion and box and of zero <b>Iechani</b> limensio ial meth nger wa chrodin	pretation o lear and perators), o evaluation momentur d its influe point energing cs-II onal box. S and. Zero point equation ger wave equation	fΨ and Hermit commuti of avera n, pictor nce on gy. chroding oint ener n for the quation
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo operators. Schrodinger wave ec position, average more representation of the cinetic energy of the Unit – 2 The concept of dege wave equation for a lo of a particle possess limensional Rigid ro hydrogen atom, sepa	Number oflectures = 12um Mechanics; Schurtainty principle;mentum and angulaquation for a particleomentum and deteree wave equation ofparticle in each suNumber oflectures = 8neracy among enerlinear harmonic oscing harmonic motiootator, energy of riguration of variables	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty f a particle in one dime ccessive quantum level, <b>Title of the Unit: Qua</b> gy levels for a particle i illator & its solution by p on and its consequence. id rotator, space quantiz in spherical polar coord	Max-Bo algeb as Herr imension in posit ensional concept ntum M n three of polynom Schrodi zation; S inates.	orn inter ra , Lin nitian o nal box; ion and box and of zero <b>Iechani</b> limensio ial meth nger wa chrodin	pretation of lear and perators), of evaluation momentur d its influe point energy cs-II onal box. S and. Zero point equation ger wave en	fΨ and Hermit commuti of avera n, pictor nce on t gy. chroding oint ener n for the quation
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo- operators. Schrodinger wave ec- position, average mo- representation of the cinetic energy of the Unit – 2 The concept of dege wave equation for a b of a particle possess limensional Rigid ro hydrogen atom, sepa Unit – 3	Number of         lectures = 12         im Mechanics; Schirtainty principle;         rtainty principle;         mentum and angular         quation for a particle         omentum and deter         e wave equation of         particle in each surface         Number of         lectures = 8         neracy among ener         ing harmonic motio         otator, energy of rigoration of variables         Number of         neracy among energy of rigoration of variables	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty a particle in one dime ccessive quantum level, <b>Title of the Unit: Qua</b> gy levels for a particle i illator & its solution by p on and its consequence. id rotator, space quantiz in spherical polar coord <b>Title of the Unit: The</b>	Max-Bo algeb as Herr imension in posit ensional concept <b>intum N</b> n three of polynom Schrodi zation; S inates. <b>rmodyn</b>	orn inter ra , Lin nitian o nal box; ion and box and of zero <b>Iechani</b> limensio ial meth nger wa chrodin <b>amics</b>	pretation of lear and perators), of evaluation momentur d its influe point energing cs-II onal box. S nod. Zero point equation ger wave equation	fΨ and Hermit commution of avera n, pictor nce on to gy. chroding point ener n for the quation
Unit-1 Postulates of Quantu Heisenberg's unce Operators(linear mo- operators. Schrodinger wave ec- position, average mo- representation of the cinetic energy of the Unit – 2 The concept of dege wave equation for a 1 of a particle possess limensional Rigid ro- ydrogen atom, sepa Unit – 3	Intervention	rodinger wave equation; Operators and their ar momentum operators e in one, two and three d mination of uncertainty f a particle in one dime ccessive quantum level, <b>Title of the Unit: Qua</b> gy levels for a particle i illator & its solution by p on and its consequence. id rotator, space quantiz in spherical polar coord <b>Title of the Unit: The</b>	Max-Bo algeb as Herr imension in posit ensional concept <b>intum M</b> n three of polynom Schrodi cation; S inates. <b>rmodyn</b>	orn inter ra , Lin nitian o nal box; ion and box and of zero <b>Iechani</b> limensio ial meth nger wa chrodin; <b>amics</b>	pretation o lear and perators), o evaluation momentur d its influe point energing cs-II onal box. S od. Zero po twe equation ger wave early and the second s	fΨ and Hermit commution of avera n, pictor nce on gy. chroding pint ener n for the quation
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Brief resumé of first and second Law of thermodynamics. Entropy changes in reversible and irreversible processes; variation of entropy with temperature, pressure and volume, entropy concept as a measure of unavailable energy and criteria for the spontaneity of reaction; free energy functions and their significance, criteria for spontaneity of a process; partial molar quantities (free energy, volume, heat concept), Gibbs-Duhem equation, variation of chemical potential with temperature and pressure.

Unit – 4	Number of	Title of the Unit: Classical Thermodynamics
	lectures = 8	

Thermodynamics II: Third law of thermodynamics (Nernst heat theorem, determination of absolute entropy, unattainability of absolute zero) and its limitation.

Phase Rule, Fugacity & Activity: Phase Rule, Phase diagram for two completely miscible components systems. Concepts of fugacity, fugacity of gases and its determination. Activity and activity coefficient, choice of standard states, determination of activity coefficient for solute and solvent.

# 12. Brief Description of self-learning / E-learning component

- 1. http://epgp.inflibnet.ac.in.
- 2. https://youtu.be/lH9SNnQCs54
- 3. https://youtu.be/10F1W80XN64
- 4. http://nptel.ac.in/courses/103101004/5
- 5. https://chemistry.mit.edu/classes/
- 6. https://www.edx.org/course/quantum-world-harvardx-chem160x#!

# 13. Books Recommended

- 1. Glasstone, S. Theoretical Chemistry ISBN 978-0716735397
- 2. Glasstone, S. Thermodynamics for Chemists ISBN 1406773220, 9781406773224
- 3. A. Chandra Introductory Quantum Chemistry Paperback 2017 ISBN 9780074620540
- 4. Donald A. McQuarrie Quantum Chemistry Paperback 2016 ISBN 9788130918945
- 5. Barrow, G.M. Physical Chemistry. ISBN 9780071140485
- 6. Srivastava, R.C., S.K. Saha and A.K.Jain. Thermodynamics ISBN 81-203-2498-6
- 7. Pauling, L. Introduction to Quantum Mechanics with Applications to Chemistry ISBN <u>9780486648712</u>

2. Course Name	Stereo Chemistry and	Organic Reaction	Ι	5	Т	P
	Mechanism	5				
3. Course Code	17060103		3	3	0	0
4. Type of Course	e (use tick mark)	Core (🖌	DS	E ()	SE	CO
5. Pre-requisite (if any)	B.Sc. (Hons) Chemistry or B.Sc. (Non Medical /Medical)	6.Frequency (use tick marks)	Even ()	Odd (•)	Either Sem ()	Every Sem ()
7. Total Number	of Lectures. Tutorials	s. Practicals				
Lectures = 40	,,,	Tutorials = Nil	Practic	al = Nil		1.1.1.1
8. Course Descri	ption:					
chiral drugs have be nechanisms of di idvanced topics car	ecome an integral part of fferent chemical reaction be built up.	of the pharmaceutical ons and will lay t	l industry he foun	y. This c dation c	ourse also on to whi	covers the covers the covers the covers the covers the covers and the covers
9. Course Object	tives:					
<ol> <li>2. Understand diff</li> <li>3. Study different</li> <li>4. Study the asym</li> <li>0. Course Outcon</li> </ol>	ferent conformations an types of reactions, their metric synthesis and its nes (COs):	d configurations of c mechanisms and the importance in organ	organic n eir stabil ic synthe	nolecule ity. esis.	s	
<ul> <li>Identify the ster</li> <li>Know the relation</li> <li>Develop capacity</li> <li>Know about the</li> <li>11. Unit wise deta</li> </ul>	eocenters in a molecule onship between enantion ty to solve the organic re- regio and chemoselecti iled content	and assign the confi mers and their specif eaction mechanisms ivity, and different ty	guration fic rotation related p pes of el	as R or ons. problems liminatio	S 5. on reaction	15.
Jnit – 1	Number of lectures	Title of the unit: S	tereoch	emistry		
	= 11		·	chilister y		
Stereoisomerism: C vith one, two or mo Configuration non arbon(biphenyls, a somerism and E, Z helicity. Cyclostereoisomer cyclohexenes, cyclo Asymmetric Induc	Classification, Optical i ore chiral centers. nenclature: D, L and R allenes, spiranes), Opti configurations, propert ism: Configurations, co bhexanones, halocycloho tion:Cram's, Prelog's a	Somerism due to as ,S configurations. O ical isomerism of n ties of geometrical is onformations and sta exanones, decalins, o and Felkin-Ahn mod	symmetr ptical iso itrogeno comers.A ubility of lecalols a el	ic carbo omerism us com xial and cyclohe and deca	in atoms: in absenc pounds, g l planar ch exanes (mo ilones.	molecul e of chir eometric irality ar ono & d
Jnit – 2	Number of lectures = 9	Title of the Nucleophilic Subs	unit: A titution	Aliphati (Reaction)	c and on Mechai	Aromat nisms)
Aliphatic Nucleop mechanism SET Neighbouring grou cations, Nucleophil reactivity due to –	milic Substitution: The mechanism. The neig p participation by pi a lic substitution at allyl substrate structure, atta	the $S_N 2$ , $S_N 1$ and $S_N 2$ , $S_N 1$ and $S_N 2$ , $S_N 1$ and $S_N 2$ , $S_N 2$	Ni mech nechanisi lassical l and vi leaving g	anisms, m (ancl non clas nylic ca group ar	mixed S <sub>1</sub> himeric a ssical & p arbon. Effo nd reaction	N1 & Si ssistance ohenoniu ect on the n mediur
Alterne	R		AD	1	- M	

Ambident nucleophiles and substrates regioselectivity.

Aromatic NucleophilicSubstitution:  $S_NAr$ ,  $S_N1$ , benzyne and  $S_{RN1}$  mechanisms. Reactivity effect of substrate structure, leaving group and nucleophile. The von Richter, Sommelet-Hauser, and Smiles rearrangements.

Unit – 3	Number of lectures	Title	of	the	unit:	Aliphatic	and	Aromatic
	= 9	Electr	ophi	lic Su	bstitutio	on		

Aliphatic Electrophilic Substitution: Bimolecular mechanisms -  $S_E2$  and  $S_Ei$ . The  $S_E1$  mechanism, Electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity.

Aromatic Electrophilic Substitution: The arenium ion, mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reaction, Gattermann-Koch reaction, Pechmann reaction, Houben – Hoesch reaction, Fries rearrangement.

Unit – 4	Number of lectures	Title of the unit: Free Radical Substitution and
	= 11	Elimination Reactions

**Free Radical Reactions:** Types of free radical reactions, free radical substitution mechanisms. Mechanisms at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. Effect of solvents on reactivity. Allylichalogenation (NBS), oxidation of aldehydes to acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction, Free radical rearrangement, Hunsdiecker reaction, Kolbe reaction, Hydroxylation of aromatics by Fenton's reagent.

**Elimination Reactions:** The  $E_2$ ,  $E_1$ ,  $E_{1cB}$  mechanisms. Orientation of the double bond. Effects of substrate structure, attacking base, leaving group and medium on reactivity. Mechanism and orientation in pyrolytic eliminations.

# 12. Brief Description of self-learning / E-learning component

- 1. http://www.colby.edu/chemistry/CH241F/Chapter%204.pdf
- 2. https://onlinecourses.nptel.ac.in/noc17\_cy11/announcements
- 3. http://nptel.ac.in/courses/104105086/
- 4. http://ocw.uci.edu/courses/chem\_201\_organic\_reactions\_mechanisms\_i.html
- 5. https://swayam.gov.in/courses/189-organic-chemistry-iii-reaction-mechanisms-2
- 6. https://faculty.chemistry.harvard.edu/myers/pages/chem-115-handouts
- 7. http://www.cureffi.org/tag/chem-20/
- 8. https://archive.org/details/EvansD.A.HarvardsAdvancedOrganicChemistry2003/page/n51
- 9. https://www.masterorganicchemistry.com/2013/07/30/free-radical-reactions

# 13. Books Recommended

- 1. Stereochemistry of carbon compounds, E.L.Eliel and S.H. Wilen, Wiley, ISBN: 9788126515707
- Stereochemistry of organic compounds- Principles and Applications, D. Nasipuri, NEW AGE; Third edition (2018), ISBN-13: 978-8122430295
- Advanced Organic Chemistry Jerry March, John Wiley & Sons Inc; 3rd edition, ISBN:978-0471854722.
- Advanced Organic Chemistry, <u>Part A: Structure and Mechanisms</u>, F.A. Carey, R.J. Sunberg, Publisher: Springer; 5th edition (2008), **ISBN-13**: 978-0387683461
- Highlights of Organic Chemistry, W.J. L. Nobel; An Advanced Text Book, CRC Press; 1 edition (1974), ISBN-13: 978-0824762100

 Stereochemistry conformation and Mechanism – P. S. Kalsi, New Age Publishers; Tenth edition (1 January 2019), ISBN-13: 978-9387788329

7. A Guide Book to Mechanism in Organic Chemistry, P.Sykes, BH Kishan, earson Education; 1

ADD

# edition (2013), ISBN-13: 978-8131793558

- Structure and Mechanism in Organic Chemistry, C. K. Ingold, CBS; 2 edition (2000), ISBN-13: 978-8123909752
- 9. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice Hall; 6th edition (January 27, 1992), ISBN-13: 978-0136436690
- Reaction Mechanism in Organic Chemistry, S. M. Mukherji and S. P. Singh, Trinity, Macmillan Publishers India (1984), ISBN-13: 978-0333904619

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<ol> <li>Course Nam</li> <li>Course Cod</li> <li>Type of ( mark)</li> <li>Pre- requisite (if any)</li> <li>Total Number</li> <li>Lectures = Nil</li> <li>Course Descr The lab work f volumetric metho be taken and streated</li> </ol>	e Ino Pra e 170 Course ( B.Sc. (He Chemistr B.Sc. (Ne Medical/	rganic ctical I 060104 use tick ons) ry or on	Chemistry Core () 6. Frequency	L 0 DS	Т 0 ЕО	SE	P 4 C ()
<ol> <li>Course Cod</li> <li>Type of (mark)</li> <li>Pre-requisite (if any)</li> <li>Total Number</li> <li>Total Number</li> <li>Course Descr</li> <li>The lab work f volumetric methodo be taken and streated and volumetric area</li> </ol>	e 170 Course (1 B.Sc. (He Chemistr B.Sc. (Ne Medical/ r of Lectu	060104 use tick ons) ry or on	Core () 6. Frequency	0 DS	0 E ()	SE	4 C ()
<ul> <li>4. Type of (mark)</li> <li>5. Pre-requisite (if any)</li> <li>7. Total Number</li> <li>7. Total Number</li> <li>Lectures = Nil</li> <li>8. Course Description</li> <li>8. Course Description</li> <li>7. The lab work for the lab work for</li></ul>	B.Sc. (He Chemistr B.Sc. (Ne Medical/ r of Lectu	use tick ons) ry or on	Core () 6. Frequency	DS	E ()	SE	<b>C</b> 0
<ol> <li>5. Pre- requisite (if any)</li> <li>7. Total Number</li> <li>7. Total Number</li> <li>7. Total Number</li> <li>8. Course Descr</li> <li>The lab work for the lab</li></ol>	B.Sc. (He Chemistr B.Sc. (Ne Medical/ of Lectu	ons) ry or on	6. Frequency	Even ()			v
7. Total Numbe Lectures = Nil 8. Course Descr The lab work f volumetric metho be taken and strea and volumetric ar	r of Lectu	Medical)	(use tick marks)		Odd ()	Either Sem ()	Every Sen O
<b>Lectures = Nil</b> 8. Course Descr The lab work f volumetric metho be taken and stren and volumetric ar		res, Tutor	ials, Practicals				
8. Course Descr The lab work f volumetric metho be taken and strea and volumetric ar		Tutorials	= Nil		Practic	al = 52	
and controlled a	or this se d and Cer ngths of in alyses.	emester fo imetry. In ndividual m	cuses on Quan the former anal- netal ions in thes	ntitative In yses, bina se mixture	norganic ry mixtur s will be	Analysis by res of metal con determined by	gravimetric mplexes wil gravimetric
<ul> <li><b>9. Course Object</b></li> <li>Upon successful of</li> <li>1. To separate a methods</li> <li>2. To separate a methods</li> <li>3. To do determ</li> </ul>	ives: completion and detern and detern ination of	n of this countries of this countries the second se	urse, the student elected binary n lected binary m f Ferrous, Oxala	will be ab nixtures o nixtures of nixtures of nte and Nit	le to: f metal i f metal ions	ons employing ons employing using cerimetry	g volumetri gravimetri y.
<ol> <li>To learn quali</li> <li>Course Outco</li> </ol>	tative ana	lysis of ino s):	rganic compoun	ıds.			
<ol> <li>Jpon successful of</li> <li>Demonstrate metal ions usi</li> <li>Identify and s</li> <li>Apply the ana</li> <li>Perform the environment.</li> </ol>	ompletion the knowl ng various olve the pr lytical rea qualitative	of this cou edge of se s methods. roblems rel soning for e analysis	arse, the student paration and de ated to the binar determination st of inorganic co	will be ab termination try mixture trengths of compounds	le to: n of the s of meta f anions o which 1	ions in binary l ions. f inorganic cor eads to a safe	mixtures o npounds e laboratory
11. List of Expendence	iments(A	t least seve	en experiments	to be per	formed b	y the student)	1
I. Estimate the f 1. Copper as cop 2. Nickel as nic II. Separation a gravimetric met a. Silver-Cop b. Copper-N	ollowing in oper thiocy ckel-dmg of and detern hods oper ckel nc agnesium rium	metal ions /anate complex mination o	gravimetrically	y. g two me	tal ions i	involving volu	metric and

# **III.Determination by Cerimetry**

- a. Ferrous
- b. Oxalate
- c. Nitrite

# 12. Brief Description of self learning / E-learning component

- 1. https://www.youtube.com/watch?v=tGHJ6LUUBIY
- 2. https://www.youtube.com/watch?v=0HZ7\_muDE\_8
- 3. https://www.youtube.com/watch?v=GI\_o\_34dVcM
- 4. <u>https://www.youtube.com/watch?v=cptn5HCEK54</u>

# 13. Books Recommended

- 1. Basic Principles of Practical Chemistry", Venkatesan, V, Veeraswamy, R and Kulandaivelu, A.R, 2nd edition, Sultan Chand and Sons Publication, New Delhi. **ISBN**: 9788180547768
- 2. Advanced Experimental Chemistry", Gurtur, J. N. and Kapoor, R., Vol. I, S. Chand & Co., Ltd, New Delhi ISBN: 9788192959887.
- 3. Advanced Practical Chemistry, 8<sup>th</sup> Edition, Pragati Prakashan, Siddiqui, I.R., Singh, J., Shrivastava, J., Yadav, L.D.S., Singh, R.K.P., Singh, J., ISBN:: 978-93-86633-50-7
- Advanced Inorganic Analysis, Agarwal, S.K., Lal, K. Pragati Prakashan ISBN: 978-93-87151-38-3
- Vogel's Textbook of Quantitative Inorganic Analysis, Pearson Education, Mendham, J., ISBN-13: 978-8131723258
- 6. Vogel's Qualitative Inorganic Analysis, Pearson Education, Svehla, G., Sivasankar, B., ISBN:9788131773710;

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2. Course Name	Physical Chemist	try Practical –I		L	T		Р
3. Course Code	17060105			0	0		4
4. Type of Course (use tick mark)		Core (↔)		DS	E ()	SEC ()	
5. Pre-requisite (if any)	B.Sc. (Hons) Chemistry or B.Sc.	6. Frequency (use	tick	Even O	$\begin{array}{c} \text{Odd} \\ (\leftrightarrow) \end{array}$	Either Sem ()	Every Sem ()
	(Non Medical/Medical)	marks)	8				
7. Total Number	of Lectures, Tutoria	lls, Practical					
Lectures = Nil		l'utorials = Nil		Pr	actical =	= 52	с.
3. Course Descri	ption:						
the concept of heat liquids such as refraction develop method	at of neutralization. It active index, surface t	t also helps the st tension and adsorp	uden tion.	ts to learning the termination of termi	arn the urse wil	various pr l also give	operties a a platfor
9. Course Objec	tives:	s properties of fige	1145.				
The objectives of t	his course are						1.126.7
<ul> <li>To impart know Weak acid /We</li> <li>To introduce the To understand</li> </ul>	vledge of concept of va ak base, Strong acid/V e concepts of partition the surface tension and vledge of concepts of	arious conductome Weak base and We coefficient and ec d adsorption of dif	etric t eak ac juilib feren	titration cid/Strop prium co nt system	s of Strong base Strong base Stant Stant	ong acid/S	trong bas
. To explain know	wledge of concept of p	oH meter					
to. Course Outco							
Strong acid/We 2. Describe the co 3. Determine parti 4. Predict surface	ak base and Weak acid ncept of pH through w tion coefficient and ec tension of liquids and ments(At least seven	d/Strong base. working of instrume quilibrium constan adsorption of solic experiments to be	ents l t of v ls	like pH various s	meter. systems	student)	
	nents(//t least seven	experiments to be	c per	Iormeu	by the	student)	
i HCl vsNaOH titr	y						
i.Oxalic acid vs Na	aOH titration						
i.CH <sub>3</sub> COOH vs Na	aOH titration.						
Mixture of CH <sub>3</sub> C	OOH+HCl vs NaOH						
2. Surface tensio	n	an an tao					
rmine interfacial to	ension of two immisci	ble liquids.					
5. Ausorption	ation of Ovalic acid ar	d Acetic acid on a	hara	0.01			
b nH metric	stion of Oxane actu an		marco	Ual.			
1. HCl vs NaC	OH titration.						
	vs NaOH titration.						
<ol><li>Oxalic acid</li></ol>	M OTT						
<ol> <li>Oxalic acid</li> <li>CH<sub>3</sub>COOH</li> </ol>	vs NaOH titration.						
<ol> <li>Oxalic acid</li> <li>CH<sub>3</sub>COOH</li> <li>Distribution La</li> <li>To determin</li> <li>To determin</li> <li>Determination</li> </ol>	vs NaOH titration. w ne partition coefficient ne the partition coeffic on of Equilibrium con	t of benzoic acid be ient of Iodine between stant for $I_2 + I^2 = I_1^2$	etwee veen [3 <sup>-</sup>	en benze Carbon	ene and tetrachle	water. oride and	water.

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# 12. Brief Description of self-learning / E-learning component

- 1. https://youtu.be/E0oYzyJrKGg
- 2. https://www.britannica.com/science/surface-tension
- 3. https://youtu.be/vMOa7wrP3w0
- 4. https://nptel.ac.in/courses/108105063/pdf/L-08(SS)(IA&C)%20((EE)NPTEL).pdf
- 5. https://www.thefreedictionary.com/distribution+law

# 13. Books Recommended

- 1. Khosla, B.D., V.C. Garg and A. Gulati. Senior Practical Physical Chemistry.
- 2. Thawale, A. and P. Mathur. Experimental Physical Chemistry.
- 3. Vishwanatha, B. and P. S Raghav. Practical Physical Chemistry.
- 4. Sindhu, P.S. Practical in Physical Chemistry.

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Comme Code	Organic Chen	histry Practical-I		L		Т	P	
5. Course Code	17060106			0		0	6	
4. Type of Course (use tick mark)		Cor	e (🖍	()			SEC ()	
5. Pre-requisite (if any)	B.Sc. (Hons) Chemistry or B.S (Non	c. 6. Freq marl	uency tick (s)	Even ()	Odd ()	Either Sem ()	Every Sem (	
7 Total Number	Medical/Medical	) miala Dreaticala						
. Total Number	of Lectures, 1 uto	Tratesials	•		D 41 1	50		
Course Degen	Intions	1 utorials = N	u		Practical	= /8		
This Course will levelop and pract geometrical isom synthesis. This course compounds	introduce the stude ice independent ex- ers and stereoisom rse will also give	ents to synthesize (xperimental skill ers) and differen a platform to dev	e the org s. Stude t reactivy velop dif	ganic co nts will re intern fferent f	mpound learn st nediates methods	s and enable reochemi formation to synthes	ole them cal aspec during t ize organ	
<ol> <li>Course Objec</li> <li>The objectives of t</li> <li>To introduce t</li> <li>To learn Cond</li> <li>To explain Nu</li> <li>To understand</li> <li>To learn the h</li> </ol>	tives: his course are: he standard technic lensation reaction a icleophilic aromatic Rearrangement rea andling of organic o	ques used for organd carbene additic/aliphatic substitactions involving chemicals safely	anic synt on ution rea carboca and desc	hesis action tions ar tribe the	id carban	ions ial dangers		
0. Course Outco	mes (COs):				a - 1			
Jpon successful co Perform variou Design organic Describe dispo	ompletion of this co is organic synthesis synthetic methods sal techniques and lling of instruments tion techniques for	burse, the student by utilizing vari- laboratory emerg used for organic	s will be ous synth ency pro synthes	able to netic tec ocedures	: chniques s		×	
5. Apply purifica	and weaking des for	the purification of	1 organi	e compo	Junus			
1. List of Experi	ments (At least sev	the purification c	to be pe	erforme	ed by the	student)		
<ul> <li>Apply purifica</li> <li>1. List of Experi</li> <li>Preparations involve active intermedia         <ul> <li>(a) Condensa</li> <li>(b) Carbene a</li> <li>(c) Nucleoph</li> <li>(d) Rearrange</li> </ul> </li> <li>Note: Overall at 1</li> </ul>	ments (At least sev ving stereochemica ites: tion reaction, addition, ilic aromatic/alipha ement reactions inv east 10 experimen	the purification of ven experiments l aspects (geomet ntic substitution re olving carbocation ts should be per	to be period iso	erforme mers an arbanic	ed by the ad stereoi	somers) ar	d differe	
<ul> <li>Apply purifica</li> <li>1. List of Experi</li> <li>Preparations involve</li> <li>eactive intermedia</li> <li>(a) Condensa</li> <li>(b) Carbene a</li> <li>(c) Nucleoph</li> <li>(d) Rearrange</li> <li>Note: Overall at 1</li> </ul>	ments (At least sev ving stereochemica ites: tion reaction, addition, ilic aromatic/alipha ement reactions inv east 10 experimen	the purification of ven experiments l aspects (geomet atic substitution re- olving carbocation ts should be per-	to be period iso	erforme mers an arbanic	ed by the od stereoi	somers) ar	nd differe	

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# 13. Books Recommended

- 1. Chapman and Hall, 5th edition, Textbook of Practical Organic Chemistry, 1996.
- 2. Nicolas Bogliotti, RobaMoumné, Multi step organic synthesis, A guide through experiments, Dec 2017.
- 3. Brian S, Furniss , Vogels text book of practical organic chemistry, 5th addition,.
- 4. Tatchell, A. R. Vogel's Textbook of Practical Organic Chemistry. John Wiley.

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	Professional Ethic	s and	L	Т		Р
	Human Values					
3. Course Code	17060107		2	0		0
4. Type of Course (use	e tick mark)	Core ()	DSE ()	AEC (√)	SEC ()	OE ()
5. Pre-requisite	NA	6. Frequency	Even ()	Odd (✔)	Either	Every
(if any)		(use tick marks)			Sem ()	Sem ()
7. Total Number of Le	ectures, Tutorials, l	Practical				
Lectures = 26		Tutorials	= 0	Practical	l = 0	
3. Course Description	:					
<ul><li>Ociety and family.</li><li>Ourse Objectives:</li></ul>						5
1. To understand I	Ethics and Univers	al Declaration	on on Bioeth	ics and its	need.	
2. To give due re	gard to nature and	d other form	ns of life by	protecting	, the envir	onment a
3 To inculcate m	responsible citize	ens lues for the s	ustainable a	rowth of th	a society	
4. To become pr	ofessionally stron	g by taking	z responsibi	lity for w	hat they a	to in the
professional and	d social life.	8 - 92	5 F		nut they t	io in in
10. Course Outcomes (	COs):					
Jpon successful compl	etion of this cours	e, the studen	ts will be ab	le to:		
. Understand the value	ues of ethics and m	noral values	deenly.			
Understand the value	le of environment	and respect	for noture			
2. Onderstand the val		and respect				
5. Realize the values (	of responsible citiz	ens to work	for the socie	ty.		
. Take strong decisio	ns and perform the	eir duties res	ponsibly as a	a profession	nal.	
1. Unit wise detailed c	ontent					
Jnit-1 Numb	er of lectures = 6	Title of the	e unit: Introc	luction to F	thics and H	Bioethics
Unit-1 Numb	er of lectures = $6$ Understanding Ethic	Title of the cs, Medical E	e unit: Introd thics and Bio	luction to E ethics, Histo	Cthics and H ory and Dev	Bioethics velopment
J <b>nit-1</b> Numb ntroduction, Definition, Ethics, Universal declarat	er of lectures = $6$ Understanding Ethic tion on Bioethics, N	Title of the cs, Medical E eed and Impo	e unit: Introd thics and Bio rtance of prof	luction to E ethics, Histo essional eth	Cthics and H ory and Dev ics,	Bioethics velopment
Jnit-1Numbntroduction, Definition,Ethics, Universal declarateJnit -2NumbEnvironmental Ethics, R	er of lectures = $6$ Understanding Ethiction on Bioethics, N er of lectures = $6$ lespect for nature,	Title of the cs, Medical E eed and Impo Title of the Respect for o	e unit: Introc thics and Bio rtance of prof e unit: Differ cultural diver	luction to E ethics, Histo essional eth ent types of sity and plu	Cthics and I ory and Devics, f Ethics tralism. Bio	Bioethics velopment
Jnit-1Numbntroduction, Definition, Ethics, Universal declarateJnit -2NumbEnvironmental Ethics, REthical use of animals in	er of lectures = $6$ Understanding Ethic tion on Bioethics, N er of lectures = $6$ lespect for nature, In the laboratory, D	Title of the cs, Medical E eed and Impo Title of the Respect for o isaster Bioeth	e unit: Introd thics and Bio rtance of prof e unit: Differ cultural diver- tics, Ethics in	luction to F ethics, Histo essional eth ent types of sity and pho Media and	Cthics and H ory and Dev ics, f Ethics aralism. Bio 1 Technolog	<b>Bioethics</b> velopment o-Safety a gy, Resear
Jnit-1Numbntroduction, Definition, Ethics, Universal declarateJnit -2NumbEnvironmental Ethics, R Ethical use of animals in Ethics, Ethical Issues in C	er of lectures = $6$ Understanding Ethic tion on Bioethics, N er of lectures = $6$ lespect for nature, n the laboratory, Di Cyber space.	Title of the cs, Medical E eed and Impo	e unit: Introc thics and Bio rtance of prof e unit: Differ cultural diver- tics, Ethics in	luction to E ethics, Histo essional eth ent types of sity and pho Media and	Cthics and H ory and Dev ics, f Ethics aralism. Bio d Technolog	Bioethics velopment o-Safety a gy, Resear
Unit-1Numbntroduction, Definition, Ethics, Universal declaratUnit -2NumbEnvironmental Ethics, R Ethical use of animals in Ethics, Ethical Issues in CUnit -3Numb	er of lectures = 6 Understanding Ethio tion on Bioethics, N er of lectures = 6 despect for nature, 1 in the laboratory, Di Cyber space. er of lectures = 7	Title of the cs, Medical E eed and Impo Title of the Respect for o isaster Bioeth Title of the	e unit: Introd thics and Bio rtance of prof e unit: Differ cultural diver- tics, Ethics in e unit: Value	luction to E ethics, Histo essional eth ent types of sity and plu Media and of Human	<b>Cthics and H</b> ory and Devices, <b>f Ethics</b> aralism. Bio         1 Technolog         Life         Devices	Bioethics velopment o-Safety a gy, Resear
Jnit-1Numbntroduction, Definition, Ethics, Universal declarateJnit -2NumbEnvironmental Ethics, REthical use of animals in Ethical Issues in CJnit -3NumbHuman Rights and ValuateIntegrity, Religious and Charing of benefits.	er of lectures = 6 Understanding Ethio tion on Bioethics, N er of lectures = 6 despect for nature, 1 in the laboratory, Di Cyber space. er of lectures = 7 des: Autonomy, Co Cultural Values, Imp	Title of the         cs, Medical E         eed and Impo         Title of the         Respect for o         isaster Bioeth         Title of the         onsent, Equal         oortance of a	e unit: Introd thics and Bio rtance of prof e unit: Differ cultural diver- tics, Ethics in e unit: Value ity, Confiden Family, Guida	luction to E ethics, Histo essional eth ent types of sity and plu Media and of Human tiality, Vul ince to your	<b>Cthics and H</b> ory and Devices, <b>f Ethics</b> aralism. Bio         1 Technolog <b>Life</b> nerability and         negsters, Gen	Bioethics velopment o-Safety a gy, Resear and Persor ider Equal
Jnit-1Numbntroduction, Definition,Ethics, Universal declarateJnit -2NumbInvironmental Ethics, REthical use of animals inEthics, Ethical Issues in CJnit -3NumbHuman Rights and Valuentegrity, Religious and Charing of benefits,Jnit - 4Numb	er of lectures = 6 Understanding Ethio tion on Bioethics, N er of lectures = 6 espect for nature, I in the laboratory, Di Cyber space. er of lectures = 7 ues: Autonomy, Co Cultural Values, Imp er of lectures = 7	Title of the         cs, Medical E         eed and Impo         Title of the         Respect for d         isaster Bioeth         Title of the         onsent, Equal         portance of a 1         Title of the	e unit: Introd thics and Bio rtance of prof e unit: Differ cultural diver- tics, Ethics in e unit: Value ity, Confiden Family, Guida	luction to E ethics, Histo ressional eth ent types of sity and plu Media and of Human tiality, Vul unce to your sional Ethi	Cthics and H ory and Dev ics, f Ethics aralism. Bio d Technolog Life nerability a ngsters, Gen	Bioethics velopment o-Safety a gy, Resear and Persor ider Equali

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Ashan".

Professional Ethics and Public Policy, Goals, Dignity of Labour, Responsibilities towards Safety and Risk, Voluntary vs involuntary Risk, Designing and Research ethics, Privacy, Authorship, Intellectual Property Rights.

### 12. Brief Description of self learning / E-learning component

- 1. https://www.youtube.com/watch?v=cFOZplkRqsk
- 2. https://www.youtube.com/watch?v=Fqt7m8LH5GY
- 3. https://www.youtube.com/watch?v=2VYF\_t51FyE
- 4. https://www.youtube.com/watch?v=9JJykyE2MHw

- 1. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana Maruthi Publications.
- Professional Ethics and Human Values by A. Alavudeen, R.KalilRahman and M. Jayakumaran University Science Press.
- 3. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill 2013

1. Name of the Dep	artment: Chemis	stry			
2. Course Name	Analytical	L		Т	P
	Chemistry				
20 01	170(0100	26		0	0
3. Course Code	(use tick mark)	20	DSF ()	AFC O SEC	
5 Pre-requisite	NA	6 Frequency use ticl	Even ()	$Odd$ ( $\checkmark$ Eithe	r Every
(if any)		marks)		Sem	() Sem $()$
7. Total Number o	f Lectures, Tutori	ials, Practicals.	П		<u> </u>
Lectures = 26		Tutorials = 0	Pra	ctical = 0	
8. Course Descript	tion:				
This paper will help	the students to u	nderstand basic knowle	edge of	various analyt	ical techniques
involved in research	. The course highl	ights the application of	differen	t polarography	(DC, AC and
Raman and other (	ucal and chromat	ographic techniques. If	nstrumer	lation method	familiar with
analytical instrument	s.	by teeninques. Student	S WIII C	uso de made	lammai with
9. Course Objecti	ves:				
The objectives of this	s course are :				
1. To introduce stud	lents to instrument	s used in chemistry.			
2 To explain all the	polarographic and	l chromatographic techn	iques us	ed and their w	orking
3 To introduce inst	rumentation and w	orking of IR and Ramar	n technia	nes	onning.
4 To provide the k	nowledge for qua	ntitative and qualitative	actimat	ion of inorgan	ic and organic
compounds	inowieuge for qua	initiative and quantative	estimat	ion of morgan	ne and organic
10. Course Outcom	es (COs):				
Upon successful com	pletion of this cou	rse, the student will be a	able to:		
1. Illustrate the kno	wledge of various	analytical techniques			
2. Identify and solv	e the problems rel	ated to the structural elu	cidation	of various cor	npounds
3. Apply the analy	tical reasoning for	explaining the structure	e of com	pounds using	their analytical
data.					
4. Explain the prine	ciple and application	ons of different analytica	al instrur	nents.	
11 Unit wise detail	ed content				
Unit-1	Number of	Title of the unit: Polar	rograph	v and Electro	analytical
1	lectures = 6	methods			
Polarography (DC, A	C and pulse), cycl	ic voltammetry, coulom	etry and	anode strippin	Ig
voltammetry.					
Unit – 2	Number of	Title of the unit: Option	cal Spec	troscopic Tec	hniques
A to us to a lease wetter a	lectures $= 7$		1		
Flectron Spectroscor	and emission spec	croscopy, A-ray photoe	electron	spectroscopy	(APS), Auger
Unit – 3	Number of	Title of the unit: Infra	red and	Raman Snec	troscony
onn o	lectures $= 6$	The of the unit. Init.		Tunnin Spee	auscopy
Dispersive and Four	er Transform Infra	ared Spectroscopy, Resc	onance R	aman and Sur	face Enhanced
Raman Spectroscopy					
Unit – 4	Number of	Title of the unit: Chro	matogra	aphic Technic	lues
	lectures = 7				
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Schann	Y	$\varphi$	The state		/

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Thin Layer Chromatography, Gas Chromatography, Size exclusion Chromatography, Ion-Exchange Chromatography, HPLC (High Performance Liquid Chromatography), Chiral Chromatography.

### 12. Brief Description of self-learning/ E - learning component

1. https://www.youtube.com/watch?v=Av\_Mrlz\_wRI

2. https://nptel.ac.in/courses/113/106/113106069/

### 13. Books Recommended

1. Cheetham, A. K. & Day, P., Eds. Solid State Chemistry Techniques Clarendon Press, Oxford (1987)

2. Christian, G. D., Analytical Chemistry, 6th Ed., John Wiley & Sons, Inc. (2004).

3. Skoog, D. A., West, D. M., Holler, R. J & Nieman, T. A. Principles of Instrumental Analysis Saunders Golden Sunburst Series (1997).

4. Willard, H. H., Merritt, L. L., Dean, J. A. & Settle, F. A. (Eds.) Instrumental Methods of Analysis
- 7th Ed., Wadsworth Publishing (1988) ISBN 0534081428

5. Khopkar, S. M. Concepts in Analytical Chemistry Halsted (1984).

6. Cullity, B.D. & Stock, S.R. Powder X-Ray Diffraction, 3rd edition, Kindle Publisher 2001.

7. Stout, G.H. & Jensen, L. H. X- Ray structure Determination A Practical Guide IIed (John Wiley & Sons), 1989.



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2. Course Name	Bioinorg	anic Chem	nistry and		L		T		Р
3. Course Code	1706020	usters			2		0	-	
	1706020	1			3		0	A	0
4. Type of Course mark)	e (use tick	Core (🖌		DSE	ΕO		SE	<b>C</b> 0	
5. Pre- requisite (if any)	B.Sc. Chemistry (Non Medical/M	(Hons) or B.Sc. fedical)	6. Frequency (use marks)	y tick	Even	Ode 0	d	Either Sem ()	Every Sem ()
7. Total Number	of Lectures.	, Tutorials	, Practical						
Lectures = 40			Tutorials = N	Nil		Pra	ctic	al = Nil	
. Course Descrip	tion:			1.1					
unctions of these proteins and enzym General introduction liscussed.	elements. nes will be d on of Chemi	The role lescribed. istry of Ino	of metal ions	in v	arious bi s and Me	ologic	cal : uste	systems, a	unds will t
. Course Objectiv	ves:				1.1.1.1				
<ol> <li>To introduce si</li> <li>To explain role</li> <li>To explain role</li> <li>To explain rol</li> <li>To explain rol</li> <li>To explain rol</li> <li>To explain the</li> <li>To explain the</li> <li>Course Outcor</li> <li>Jpon successful co</li> <li>Demonstrate th</li> <li>Identify essent</li> <li>Apply the anality</li> <li>Explain the strip</li> <li>Explain the Ca</li> </ol>	tudents to est e of metal io e of metal io e of metals e of metal io chemistry <b>nes (COs):</b> mpletion of the knowledgi ial and trace ytical reason ucture and f ges and Metal	re: ssential and ons in biolo in proteins ons in enzy of Inorgan this course ge of the rol e elements the ning for exp unction of tal Cluster	d trace element gical systems a (structure and mes (structure ic Rings, Cage e, the student w le of inorganic found in nature plaining the fu vial metallopro Compounds	s and n funct and i s and vill be e met and inctic oteins	ucleotide tion) function) l Metal C e able to: als and co describe oning of v s and met	s ompoutheir trital britalloer	<u>Con</u> unds func iolo nzyr	mpounds s in nature ction gical systemes	e. ems
1. Unit wise detai	led content			30 -					
Jnit-1	Number of	lectures =	10 Title of	the u	ınit: Met	al Ior	ıs ir	1 Biologic	al System
Metal Ions in Biol n metabolic process Alkali and alkalin across membranes, nuscle contraction, Interaction of met on nucleic acids.	ogical Syste s and causes the earth me sodium-po blood clotti al ions with	ems: Gene s of disease etals in bi tassium pu ing and hor n Nucleotic	ral survey of e es, different cla ological system imp, Calcium mones. des: Metal ions	ssent sses <b>ms</b> : 1 pump s in n	ial and tr of drugs. lonophore o, Calcium nucleotide	race m es, ac m car e syste	tive rier; ems,	transport s, role of	oing factor of cation carriers i metal ion
Jnit – 2	Number of	lectures =	10 Title of	the u	nit: Met	allop	rote	ins	
<b>Daygen carriers:</b> emoglobin and my <b>litrogen fixation</b> : omplexes, photosy <b>detal transport a</b>	Porphyrins oglobin, syn Biological nthesis and od storage:	s, metallog nthetic oxy nitrogen chlorophyl Transferrin	porphyrins, H gen carrier mo fixation, Nitro ll. a, Ferritin, Side	emoj del s ogena	proteins, ystems ase, mod	struc	r ni	e and fu	nctions o , metal-N
Ashan.	Ø		b	A	P	h	1		H

Unit – 3	Number of lectures = 10	Title of the unit: Metalloenzymes
Zinc Enzymes -	- Carboxypeptidase & Carbonic	c anhydrase
Iron Enzymes -	- Catalase, peroxidase & cytoch	rome P- 450
Copper Enzyme	es - Superoxide dismutase, blue	e copper- proteins
Coenzymes - V	vitamins B <sub>12</sub>	
Unit – 4	Number of lectures = 10	Title of the unit: Chemistry of Inorganic Rings,
		Cages and Metal Cluster Compounds
Chemistry of in	organic rings, cages and metal	cluster compounds, borazines, phosphazenes,
polyhedral bora	nes, carboranes, metalloboranes	s and metallocarboranes.
12. Brief Descr	iption of self -learning / E-lea	rning component
1. https://www	v.youtube.com/watch?v=C Kg0	DEMPEJ8
2. https://www	v.youtube.com/watch?v=n8IU53	3mS7M0
3. https://www	v.youtube.com/watch?v=dZE0T	UTZtpQ
4. https://www	youtube.com/watch?v=s8jO6	8arCE
5 1 ··· //		-

5. https://www.youtube.com/watch?v=7726rvJ6mNY.

- Inorganic Chemistry: Principles of Structure and Reactivity by J.E. Huheey, Pearson ISBN-13: 978-0063503526
- 2. Metal Ions in Biochemistry by P.K. Bhattacharya, Alpha Science International Ltd; 1 editionISBN-13: 978-1842652404
- 3. Bioorganic, Bioinorganic and Supramolecular Chemistry by P.S. Kalsi and J.P.Kalsi, New Academic Science; 2nd Revised editionISBN-13: 978-9386286628

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1. Name of the Dep	artment : Chemistr	v				
2. Course Name		Chemical Kinetics	8	L	Т	Р
		Electrochemistry		_	-	-
3. Course Code		17060202		3	0	0
4. Type of Course (	use tick mark)	Core (V)	DS	E ()	SE	
5. Pre-requisite	B.Sc. (Hons)	6. Frequency	Even	Odd	Either	Every
(if any)	Chemistry or	(use tick	(	0	Sem ()	Sem ()
	B.Sc. (Non	marks)				0
	Medical/Medical)				100	1995 - L
7. Total Number of	Lectures, Tutorials	, Practicals				
Lectures = 40		Tutorials = Ni		P	actical =	Nil
8. Course Descripti	on:				actical	
This course will enab	le the post graduate s	tudents to understand	and ratio	onalize	the concer	t involve
in chemical kinetics.	It focuses the basics	of chemical kinetics	such as r	ate of r	eaction rat	te law and
apart form that it als	so covers the collision	on theory, activated	complex	theory	and the l	cinetics of
polymerisation. Stud	lents will also foc	uses on the intere	sting co	ncents	of non-e	milibriun
thermodynamics and	electrochemistry.				or non e	quinoriun
9. Course Objectiv	es:			1		
The objectives of this	course are:					
1. To provide a firm	foundation in chemic	al kinetics & electro	chemistry	and the	ermodynar	nics
2. To introduce orde	r of reaction along wi	th collision theory ar	d activat	ed com	plex theory	1
3. To provide the know	owledge of kinetics o	f polymers	a activat	eu comj	press uncor	
4. To introduce vario	ous concepts Non-Equ	uilibrium Thermodyn	amics an	d electr	ochemistry	1
10. Course Outcome	s (COs):		unites un	a ciccui	oenennsuj	
Linon successful com	alation of this course	the students will be	h1. t			
1 Demonstrate the k	nowledge of chemics	lic students will be a	Die to:	م والح الم من		•
<ol> <li>Demonstrate the k</li> <li>Identify and solve</li> </ol>	the problems related	to order of reaction	lennsuy	and the	modynam	ics
<ol> <li>Explain the mecha</li> </ol>	nism and further stu	lies in chain reaction	-			
4. Explain the therm	odynamic criteria for	non-equilibrium stat	-c			
11. Unit wise detailed	d content	non equinorium stat				
Unit-1	Number of lectur	es = 10 Titl	e of the I	Init: C	homical K	inotios I
Rate of reaction rate	law and rate consta	nt units of rate con	stant in	tegrated	rate laws	for Zero
First and Second or	ler reaction effect of	of temperature on re	action ra	tes Da	to low for	opposing
reactions of I <sup>st</sup> order	and II <sup>nd</sup> order Rat	e law for consecutiv		rallel re	actions of	F Ist order
reactions. Collision th	heory of reaction rat	tes and its limitation	ne et eric	factor	Activated	complex
theory. Ionic reactions	s: single and double	sphere models the c	omnariso	n of co	lision and	activated
complex theory	s. single and double	sphere models, the e	ompariso		insion and	activated
Unit – 2	Number of lectur	es = 10 Titl	of the	Unit: (	homical 1	Zination .
	i valiber of feetar	Kin	etics of P	olumor	izotion	xinetics :
Kinetics of Polymeriz	ation Reactions of fu	nctional groups, kind	etics of st	ten noly	merization	kinetics
of reversible reaction	s, open and closed	systems, molecular	weight of	control	stoichion	etric and
quantitative aspects; n	nolecular weight distr	ibution in linear and	non-linea	r polvn	nerization	iente une
Unit – 3	Number of lectur	es = 10 Title of th	e Unit: N	Non		
		Equilibri	um Ther	modyn	amics	
Thermodynamic criter	ria for non-equilibriu	m states, entrony pr	oduction	and en	tropy flow	entrony
balance equations for	r different irreversib	le processes (e.g	heat flow	v. chen	nical react	ion etc.)
transformations of t	the generalized flu	xes and forces.	on equi	librium	stationar	v states
		/	oqui		onnoniu	y states,
Acham.	D	V/ A	6	w	1	

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phenomenological equations, Onsager's reciprocity relations, electrokinetic phenomena, diffusion.Unit - 4Number of lectures = 10Title of the Unit: Electrochemistry

Nonideal Systems: Excess functions for nonideal solutions. Activity, activity coefficient, Debye-Huckel Theory for activity coefficient of electrolyte solutions, Determination of activity and activity coefficients ionic strength. Debye-Huckel-Bjerrum model. Overpotential, exchange current density, derivation of Butler-Volmer equation, Tafel plot.

### 12. Brief Description of self-learning / E-learning component

- 1. http://epgp.inflibnet.ac.in.
- 2. http://www.engr.uconn.edu/~jmfent/CHEG320\_electrochemistry%20lectures.pdf
- 3. https://youtu.be/uTFtaslJ0LM
- 4. http://staff.uny.ac.id/sites/default/files/jas\_ion\_transport\_in\_solution.pdf
- 5. https://chemistry.mit.edu/classes/

- 1. Bockris, J.O.M. and A.K.N. Reddy. Modern Electrochemistry Vol.1 ISBN: 978-0-306-46909-1
- 2. Laidler, K.J. Chemical Kinetics ISBN: 9780060438623
- 3. Frost, A. & G.Pearson. Kinetics & Mechanism of Reaction Rates ISBN: 978-0471035589
- 4. Eyring, H. Modern Chemical Kinetics ISBN: 978-0442173968
- 5. Laidler, K.J., H.Eyring & S. Glasstone Theories of Reaction Rates ISBN: 978-3-540-63975-6

to

1.	Name of the	Department: Chemistr	-y		
2.	Course Nam	e Organic	L	Т	Р
		Spectroscopy			
3.	<b>Course Cod</b>	e 17060203	3	0	0
4.	Type of Cou	rse (use tick mark)	Core (1)	DSE ()	SEC ()
5.	Pre- requisite (if any)	B.Sc. (Hons) Chemistry or B.Sc. (Non Medical/Medical)	6. Frequency (use tick marks)	Even Odd ()	Either Every Sem () Sem ()
7.	<b>Total Numb</b>	er of Lectures, Tutorials	s, Practicals		
Le	ctures = 40		Tutorials = Nil	Practical	= Nil
8.	<b>Course Desc</b>	ription:			
by opj stri	chemists and portunity to le uctures of orga	biochemists to analyze the earn and appraise the use anic compounds.	ne molecular structure c of spectroscopic instru	of organic comp uments in the o	bounds and provides determination of the
y.	Course Obje	ectives:			
Th	e objectives of	f this course are:	and the second		
1.	To understan	d similarities and differen	ices between spectrosco	py and spectro	metry
2.	To identify th	e basic components of sp	ectroscopic instrument	ation	
3.	To introduce	the theory of the variou	is instruments and the	signals produc	ced when analyzing
1	To demonstr	to a working knowladge	of altravial at a sight of		
4.	spectroscopy	, nuclear magnetic reson	ance (NMR) spectrosc	ov-vis) spectro	scopy, infrared (IR) trometry (MS), and
	ORD & CD	e e	( ) -	-FJ,	(1115), und
10.	Course Outo	comes (COs):			
Up	on successful	completion of this course	, the student will be abl	e to:	
1.	Determine the	e functional groups in org	anic compounds		
2.	Explain the in	nstrumentation and applic	ation of IR, NMR, UV	Visible spectro	scopy
3.	Elucidate the	structures of different org	ganic compounds by us	ing IR, NMR and	nd Mass Data.
4.	Predict the ste	ereochemistry of chiral m	olecules		
11.	Unit wise de	tailed content			8
Un	it-1 N	Sumber of lectures = 10	Title of the Spectroscopy	unit: Ultravi	olet and Visible
Inti	roduction - El	ectronic energy levels, ele	ectronic transitions and	selection rules.	The origin, general
app	bearance and d	esignation of UV bands,	absorption laws and me	easurement of a	absorption intensity,
Ab	sorption and	Intensity shifts, The ul	traviolet spectrometer,"	Woodward and	l Fieser's rules for
cal	culating ultrav	violet absorption maxima	for conjugated dienes	, unsaturated c	arbonyl compounds
and	l aromatic ca	rbonyl compounds. Ap	plication of UV spec	troscopy to pr	roblems in organic
che	mistry.				
Un	it – 2 N	umber of lectures = 10	Title of the unit:	Infrared Spec	etroscopy
Intr	roduction – E	Basic theory and instrum	nentation including FT	IR infrared s	spectrum. Units of
free	quency wavel	ength and wave number.	Molecular vibrations.	Functional gr	oup and fingerprint
reg	ions. Types o	f IR Bands, Frequency of	of vibrations of a diato	mic molecule,	factors influencing
vib	rational frequ	encies, sampling techniq	ues, characteristic freq	uencies of org	anic molecules and

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Introduction	Number of lectures = 10	Title of the unit: Nuclear Magnetic Resonanc Spectroscopy ( <sup>1</sup> H and <sup>13</sup> C NMR)
non-equivalen spin - spin c constants, Te reagents, spin <sup>1</sup> H NMR, Ch Techniques. A compounds.	Principles of NMR, Instrume t protons, Chemical shift and oupling, multiplicity of split chniques for simplification decoupling (double resonance emical shifts of <sup>13</sup> C NMR. pplications of <sup>13</sup> C NMR and <sup>14</sup>	entation techniques (CW & FT NMR), equivalent an l its measurements. Factors affecting the chemical shift tting, Short range and long-range couplings, couplin of complex spectra: solvent effects, Lanthanide shift e), NOE. Effect of sensitivity of <sup>13</sup> C NMR compared t Resolution and multiplicity of <sup>13</sup> C NMR, Decouplin <sup>1</sup> H NMR in structural elucidation of simple and complex
Unit – 4	Number of lectures = 15	Title of the unit: Mass Spectrometry& (ORD an CD)
(EI, CI, FD, F rearrangement features of fra sulphur, nitrog retro Diels – A <b>Optical Rotat</b> Linear and cin curves, Cottor structural and and Mass Spec	AB, ESI, APCI and MALDI), ions, fragment ions, even gmentation pattern of organi- gen and halogens; $\alpha$ -, $\beta$ -, ally ory <b>Dispersion (ORD) and C</b> cularly polarised lights, circu a effect. The axial haloketone stereochemical problems.Stru etra.	Mass spectrum, base peak, molecular ions, isotope ions electron rule, nitrogen rule, metastable ions. Salier c compounds including compounds containing oxyger ylic and benzylic cleavage, McLafferty rearrangement effect. Circular Dichroism (CD): llar birefringence and circular dichroism, ORD and CI e rule,octant diagrams, Application of ORD and CD to cture elucidation of organic compounds using IR, NMH
12. Brief Desc	ription of self-learning / E-le	earning component
1. https://swa 2. http://nptel 3. <u>http://ocw.</u> 4. <u>https://epg</u>	yam.gov.in/courses/252-orgar .ac.in/courses/102103044/4 uci.edu/courses/chem_203_or p.inflibnet.ac.in/Home/ViewSu	nic-spectroscopy. ganic_spectroscopy.html ubject?catid=5
<ol> <li>BOOKS Re</li> <li>Spectromet Wiley &amp; So</li> <li>W. Kemp.</li> </ol>	ric Identification of Organic ons Ltd., 0471 63404 2 Organic Spectroscopy, Palgray pic Methods in Organic Che	c Compounds, R.M. Silverstein & G.C. Bassler, Joh ve USA, ISBN: 9781403906847 emistry D.H. Williams and J. Eleming. McGraw-Hil
<ol> <li>Spectrosco ISBN: 978</li> <li>Organic Sp</li> <li>Application</li> </ol>	0077118129 ectroscopy, Jag Mohan. Naros n of Spectroscopy of Org	sa Publishing House, ISBN: 9788173195662 ganic Compounds, Dyer, J.R. Phi Learning. ISBN

3.       Course Code       17060204       0       0         4.       Type of Course (use tick mark)       Core (M)       DSE 0       SEC 0         5.       Pre- requisite (iff any)       B.Sc. (Non       (use       tick (M)       0       0       SEC 0         7.       Total Number of Lectures, Tutorials, Practicals       Even (use       Out       Practical = 78         8.       Course Description:       Practical = 78       Practical = 78         8.       Course Objectives:       Practical familiar with diff microanalysis techniques for the identification of various heavy metals in the water and soil.       Practical = 78         9.       Course Objectives:       The objectives of this course are:       Practical of familiar with diff microanalysis techniques for the identification of different cations and anions.       3.         1.       To understand the procedures for the identification of various heavy metals.       4.       To learn the determination of inorganic salts in water, soil.       10.         10.       Course Outcomes (COs):       Upon successful completion of this course, the student will be able to:       1.         11.       Demonstrate the knowledge of separation and determination of the components in an inorg mixture       2.       Processful completion of this course, the student will be able to:         12.       Predict the quality of any inorganic		ne Inorganic Chem	nistry Practical II			L	Т	P
4.       Type of Course (use tick mark)       Core (𝒴)       DSE 0       SEC 0         5.       Pre- requisite       B.Sc. (Hons) Chemistry or Medical/Medical)       6.       Frequency (use tick 0)       Even 0       0       Either       Even 0       0       SEC 0         7.       Total Number of Lectures, Tutorials, Practicals       Practical = 78       Se       Se       Se       Se         8.       Course Description:       This course provides practical training in qualitative analysis of the inorganic salt mixtures 1 different methods which also includes green approaches. Students will made familiar with diff microanalysis techniques for the identification of different cations and anions i inorganic mixtures.         9.       Course Objectives:       The objectives of this course are:         1.       To understand the procedures for the identification of various heavy metals.         3.       To explain specific properties of cations and anions.         3.       To explain the microanalysis techniques for the identification of various heavy metals.         4.       To learn the determination of inorganic salts in water, soil.         10.       Course Outcomes (COS):         Upon successful completion of this course, the student will be able to:         1.       Demonstrate the knowledge of separation and determination of the components in an inorg mixture         3.       Identify various heavy	3. Course Cod	le 17060204				0	0	4
5. Pre- requisite (if any)       B.Sc. (Hons) Chemistry or (use tick tick (I))       Even (I)       Odd Either Even (I)       Even (I)       II       Even (I)       III       Even (I)       III       Even (I)       III       Even (I)       III       IIII       IIII       IIII       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	4. Type of Co	ourse (use tick mark)	Core (	DS	SE ()		SE	<b>C</b> 0
requisite (if any)       B.Sc. (Non Medical/Medical)       (use marks)       tick (mark)       0       Sem ()	5. Pre-	B.Sc. (Hons) Chemi	stry or 6. Frequ	encv	Even	Odd	Either	Every
(if any)       Medical/Medical)       marks)       Marks         7. Total Number of Lectures, Tutorials, Practicals       Practical = 78         8. Course Description:       Tutorials = Nil       Practical = 78         8. Course Description:       This course provides practical training in qualitative analysis of the inorganic salt mixtures in different methods which also includes green approaches. Students will made familiar with difficient methods which also includes green approaches. Students will made familiar with difficient methods which also includes green approaches. Students will made familiar with difficient methods which also includes green approaches. Students will made familiar with difficient methods which also includes green approaches. Students will made familiar with difficient methods of the procedures for the identification of various heavy metals and anions.         9. Course Objectives:       The objectives of this course are:         1. To understand the procedures for the identification of various heavy metals.         2. To explain specific properties of cations and anions.         3. To explain the microanalysis techniques for the identification of the components in an inorg mixture         10. Course Outcomes (COS):         Upon successful completion of this course, the student will be able to:         1. Demonstrate the knowledge of separation and determination of the components in an inorg mixture         2. Predict the quality of any inorganic mixture         3. Identify various heavy metals as well as inorganic salts in water and soil         4. Per	requisite	B.Sc. (Non	(use	tick		0	Sem ()	Sem (
<ol> <li>Total Number of Lectures, Tutorials, Practicals</li> <li>Lectures = Nil Tutorials = Nil Practical = 78</li> <li>Course Description:</li> <li>This course provides practical training in qualitative analysis of the inorganic salt mixtures i different methods which also includes green approaches. Students will made familiar with diffmicroanalysis techniques for the identification of various heavy metals in the water and soil.</li> <li>Course Objectives:</li> <li>To understand the procedures for the identification of different cations and anions i inorganic mixtures.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain the determination of inorganic salts in water, soil.</li> <li>Ourse Outcomes (COs):</li> <li>Upon successful completion of this course, the student will be able to:</li> <li>Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>Identify various heavy metals as well as inorganic salts in water and soil</li> <li>Predict the quality of any inorganic mixture</li> <li>Identify various heavy metals as well as inorganic compounds which leads to a safe labor: environment.</li> <li>List of Experiments</li> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight ispecies (four anions and four cations, excluding insoluble salts) out of the following: Ca<sup>2+</sup>, S<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup> Anions : COs<sup>2-</sup>, S<sup>3-</sup>, SO<sub>2</sub>, SO<sub>3</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>CO<sup>-</sup>, CF, Br, F, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>-</sup>, PO<sub>4</sub><sup>3+</sup>, BO<sub>3</sub><sup>3+</sup>, C<sub>2</sub><sup>-</sup>, (Spot tests and flame tests should be carried out wherever feasible)</li> <li>Brief Description of self-learning / E-learning component</li> <li>https://www.google.co.in/url?aa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;sourcc</li></ol>	(if any)	Medical/Medical)	marks)					
Lectures = Nil       Practical = 78         8. Course Description:       This course provides practical training in qualitative analysis of the inorganic salt mixtures in the observement of the identification of various heavy metals in the water and soil.         9. Course Objectives:       The objectives:         11. To understand the procedures for the identification of different cations and anions.       3.         2. To explain specific properties of cations and anions.       3.         3. To explain the microanalysis techniques for the identification of various heavy metals.       4.         4. To learn the determination of inorganic salts in water, soil.       10.         10. Course Outcomes (COS):       100 post secessful completion of this course, the student will be able to:         11. Demonstrate the knowledge of separation and determination of the components in an inorg mixture       3.         12. Predict the quality of any inorganic mixture       3.         13. Identify various heavy metals as well as inorganic calts in water and soil       4.         4. Perform the qualitative analysis (using H <sub>2</sub> S or other methods) of mixtures - not more than eight ispecies (four anions and four cations, excluding insoluble salts) out of the following:         2. To explain the meters should be carried out wherever feasible)       12.         12. Brief Description of self-learning / E-learning component       14.         14. Tot of Experiments       14.       10.	7. Total Numl	per of Lectures, Tuto	orials, Practicals			1	1	_
<ul> <li>8. Course Description:</li> <li>This course provides practical training in qualitative analysis of the inorganic salt mixtures i different methods which also includes green approaches. Students will made familiar with diff microanalysis techniques for the identification of various heavy metals in the water and soil.</li> <li>9. Course Objectives:</li> <li>The objectives of this course are:</li> <li>1. To understand the procedures for the identification of various heavy metals.</li> <li>2. To explain specific properties of cations and anions.</li> <li>3. To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>4. To learn the determination of inorganic salts in water, soil.</li> <li>10. Course Outcomes (COS):</li> <li>Upon successful completion of this course, the student will be able to:</li> <li>1. Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>2. Predict the quality of any inorganic mixture</li> <li>3. Identify various heavy metals as well as inorganic salts in water and soil</li> <li>4. Perform the qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight is precise (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>2. Tot sufficient of selection of the component</li> <li>2. Brief Description of self-learning / E-learning component</li> <li>2. https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_Si LE_INORGANIC_SALT</li> <li>2. https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_Si LE_INORGANIC_SALT</li> <li>4. https://www.academia.edu/10186454/SEMI_MICRO_WVAW2UQZF2/2VPIXekton.pg.gda.</li> <li>2. Pridet Description of self-learning / E-learning component</li> <li>4. https://www.academia.edu/10186454/SEMI_MICRO_WVAW2UQZF2/2VPIWww.kchn.pg.gda.</li> <li>2. Pridactics%2E5krypt_lab%2</li></ul>	Lectures = Nil	Tutorials	s = Nil			Practic	cal = 78	
<ul> <li>This course provides practical training in qualitative analysis of the inorganic salt mixtures i different methods which also includes green approaches. Students will made familiar with diff microanalysis techniques for the identification of various heavy metals in the water and soil.</li> <li><b>A. Course Objectives:</b></li> <li>The objectives of this course are: <ol> <li>To explain the procedures for the identification of different cations and anions i inorganic mixtures.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>To explain the determination of inorganic salts in water, soil.</li> </ol> </li> <li><b>10. Course Outcomes (COS):</b> Jpon successful completion of this course, the student will be able to: <ol> <li>Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>Identify various heavy metals as well as inorganic campounds which leads to a safe labor environment. </li> <li><b>11. List of Experiments</b></li> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight i pecies (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>Cations : NH<sub>4</sub>*, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>4</sup></li> <li>Anions : CO<sub>3</sub><sup>2-</sup>, SO<sub>2</sub>, SO<sub>2</sub>, SO<sub>2</sub>, SO<sub>2</sub>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, T, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sub>2</sub></li> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> </ol> </li> <li><b>12. Brief Description of self-learning / E-learning component</b></li> <li>https://www.academia.cdu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.academia.cdu/10186454/SEM</li></ul>	8. Course Des	cription:						
<ul> <li>lifferent methods which also includes green approaches. Students will made familiar with diff microanalysis techniques for the identification of various heavy metals in the water and soil.</li> <li><b>2. Course Objectives:</b></li> <li>The objectives of this course are:</li> <li>1. To understand the procedures for the identification of different cations and anions i inorganic mixtures.</li> <li>2. To explain specific properties of cations and anions.</li> <li>3. To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>4. To elarn the determination of inorganic salts in water, soil.</li> <li><b>10. Course Outcomes (COS):</b></li> <li>Jpon successful completion of this course, the student will be able to:</li> <li>1. Demostrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>2. Predict the quality of any inorganic mixture</li> <li>3. Identify various heavy metals as well as inorganic compounds which leads to a safe labor: environment.</li> <li><b>11. List of Experiments</b></li> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight i pecies (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>Cations : NH<sub>4</sub>*, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup></li> <li>Anions : COs<sup>2-</sup>, S<sup>2-</sup>, So<sub>2</sub>, Su<sub>2</sub>, Su<sub>2</sub>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, CT, Br<sup>-</sup>, T, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sub>2</sub><sup>-</sup></li> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> <li><b>2. Brief Description of self-learning / E-learning component</b></li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVKEC_4QFjADegQIBAAC&amp;url=http%3A%2F%2Fwww.kcnn.pg.gda.</li> <li>2. Fide dactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgT</li></ul>	This course pro	vides practical training	ng in qualitative ar	alvsis o	of the in	organio	c salt mixt	ures usi
<ul> <li>microanalysis techniques for the identification of various heavy metals in the water and soil.</li> <li><b>2. Course Objectives:</b></li> <li>The objectives of this course are:</li> <li>1. To understand the procedures for the identification of different cations and anions i inorganic mixtures.</li> <li>2. To explain specific properties of cations and anions.</li> <li>3. To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>4. To learn the determination of inorganic salts in water, soil.</li> <li><b>10. Course Outcomes (COS):</b></li> <li>Jpon successful completion of this course, the student will be able to:</li> <li>1. Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>2. Predict the quality of any inorganic mixture</li> <li>3. Identify various heavy metals as well as inorganic salts in water and soil</li> <li>4. Perform the qualitative analysis of inorganic compounds which leads to a safe labor: environment.</li> <li><b>11. List of Experiments</b></li> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight pecies (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>2.ations : NH<sub>4</sub><sup>*</sup>, Pb<sup>2*</sup>, Bi<sup>3*</sup>, Cu<sup>2*</sup>, Cd<sup>2*</sup>, Fe<sup>3*</sup>, Al<sup>3*</sup>, Co<sup>2*</sup>, Ni<sup>2*</sup>, Mn<sup>2*</sup>, Zn<sup>2*</sup>, Ba<sup>2*</sup>, Sr<sup>2*</sup>, Ca<sup>2*</sup>, K<sup>+</sup> Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, Su<sub>2</sub><sup>-</sup>, Su<sub>2</sub><sup>-</sup>, No<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2*</sup>, Pol<sub>4</sub><sup>3-</sup>, Bo<sub>3</sub><sup>3-</sup>, Ce<sup>2*</sup>, K<sup>+</sup> Marions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, Su<sub>2</sub><sup>-</sup>, Su<sub>2</sub><sup>-</sup>, No<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, POl<sub>4</sub><sup>3-</sup>, Bo<sub>3</sub><sup>3-</sup>, Ce<sup>2*</sup>, K<sup>+</sup> Micros - Su<sub>2</sub>Citests and flame tests should be carried out wherever feasible)</li> <li><b>2. Brief Description of self-learning / E-learning component</b></li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz- nxrKziAhW</li></ul>	lifferent method	ds which also include	s green approaches	Stude	nts will	made fa	miliar wit	h differe
<ul> <li>A. Course Objectives:</li> <li>The objectives of this course are:</li> <li>To understand the procedures for the identification of different cations and anions i inorganic mixtures.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>To learn the determination of inorganic salts in water, soil.</li> <li>(I) Course Outcomes (COs):</li> <li>Jpon successful completion of this course, the student will be able to:</li> <li>Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>Predict the quality of any inorganic mixture</li> <li>I dentify various heavy metals as well as inorganic compounds which leads to a safe labor: environment.</li> <li>I List of Experiments</li> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight pecies (four anions and four cations, excluding insoluble salts) out of the following: Cations : NH<sub>4</sub><sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Nl<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup> Anions : CO3<sup>2-</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-</sup>, SO<sub>2</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>2</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>-2</sup>, PO<sub>4</sub><sup>3+</sup>, BO<sub>3</sub><sup>-3</sup>, C<sub>2</sub><sup>-1</sup>, (Spot tests and flame tests should be carried out wherever feasible)</li> <li>2. Brief Description of self-learning / E-learning component</li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiG2-</li> <li>nxrKziAhWhheYKHVKEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda.</li> <li>2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPIk2kgTohZ9I</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiG2-</li> <li>nxrKziAhWhheYKHVKEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwwww.kau</li></ul>	nicroanalysis te	chniques for the iden	tification of various	heavy	metals in	the w	ater and so	il annore
<ul> <li>In the objectives of this course are:</li> <li>To understand the procedures for the identification of different cations and anions i inorganic mixtures.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>To learn the determination of inorganic salts in water, soil.</li> <li><b>Ocurse Outcomes (COs):</b></li> <li>Jpon successful completion of this course, the student will be able to:</li> <li>Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>Predict the quality of any inorganic mixture</li> <li>Identify various heavy metals as well as inorganic salts in water and soil</li> <li>Perform the qualitative analysis of inorganic compounds which leads to a safe labor environment.</li> <li><b>II. List of Experiments</b></li> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight pecies (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>Cations : NH<sub>4</sub><sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Nl<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup> Anions : CO3<sup>2-</sup>, S<sup>2-</sup>, So<sub>2</sub><sup>-</sup>, So<sub>2</sub><sup>-3</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, Γ, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>-3</sup>, Ca<sup>2+</sup>, NC<sup>3+</sup>, Leisenbald be carried out wherever feasible)</li> <li><b>2. Brief Description of self-learning / E-learning component</b></li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-mxrKziAhWhheYKHVKEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPlk2kgTohZ9i</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-mxrKziAhWhheYKHVKEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2Fsubjects%2Fex. 6 7 and 8 inorganic qualitative analysis acidic</li> </ul>	. Course Obie	ctives:	internet of various	nourj	inotaio n	i the m	ater und ber	
<ul> <li>To understand the procedures for the identification of different cations and anions i inorganic mixtures.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>To learn the determination of inorganic salts in water, soil.</li> <li><b>O. Course Outcomes (COs):</b></li> <li>Jpon successful completion of this course, the student will be able to:</li> <li>Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>Predict the quality of any inorganic mixture</li> <li>Identify various heavy metals as well as inorganic compounds which leads to a safe labor: environment.</li> <li><b>1. List of Experiments</b></li> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight pecies (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>Cations : NH<sub>4</sub><sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, S-<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup></li> <li>Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-</sup>, SO<sub>3</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sup>2+</sup>, K<sup>+</sup></li> <li>Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-</sup>, SO<sub>2</sub><sup>-2-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sup>2+</sup>, K<sup>+</sup></li> <li>Anions : CO<sub>3</sub><sup>2-1</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-2-</sup>, NO<sub>3</sub><sup></sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, NO<sub>3</sub><sup></sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3</sup>, BO<sub>3</sub><sup>3-</sup>, C<sup>2+</sup>, K<sup>+-</sup></li> <li>Attribus://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-</li> <li>nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fw2Fwww.kchn.pg.gda, 2Fdidactics%2Fskrypt_lab%2FiADegUBBAC&amp;url=https%3A%2F%2Fw2Fwww.kau.edu.sa% Files%2F0017486%2FSubj</li></ul>	The objectives of	of this course are:						
<ul> <li>A probability of any inorganic mixtures.</li> <li>2. To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>4. To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>4. To learn the determination of inorganic salts in water, soil.</li> <li>10. Course Outcomes (COs):</li> <li>Jpon successful completion of this course, the student will be able to:</li> <li>b. Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>c. Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>d. Perdict the quality of any inorganic mixture</li> <li>d. Identify various heavy metals as well as inorganic compounds which leads to a safe labor: environment.</li> <li>11. List of Experiments</li> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight pecies (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>Cations : NH<sub>4</sub>*, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup></li> <li>Anions : CO3<sup>2-</sup>, S<sup>2-</sup>, SO2<sup>-</sup>, So2<sup>-</sup>, NO3<sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, Γ, NO3<sup>-</sup>, SO4<sup>2-</sup>, PO4<sup>3-</sup>, BO3<sup>3-</sup>, C2<sup>+</sup>, K<sup>+</sup></li> <li>Anions : CO3<sup>2-</sup>, S<sup>2-</sup>, SO2<sup>-</sup>, So2<sup>-</sup>, NO3<sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, Γ, NO3<sup>-</sup>, SO4<sup>2-</sup>, PO4<sup>3-</sup>, BO3<sup>3-</sup>, C2<sup>+</sup>, K<sup>+</sup></li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-</li> <li>nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda.2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgToAP94</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-</li> <li>nxrKziAhWhheYK</li></ul>	To understa	and the procedures t	for the identificati	on of c	lifferent	cation	s and ani	one in
<ul> <li>To explain specific properties of cations and anions.</li> <li>To explain specific properties of cations and anions.</li> <li>To explain specific properties of cations and anions.</li> <li>To learn the determination of inorganic salts in water, soil.</li> <li><b>Ocurse Outcomes (COs):</b></li> <li>Jpon successful completion of this course, the student will be able to: <ul> <li>Demonstrate the knowledge of separation and determination of the components in an inorg mixture</li> <li>Predict the quality of any inorganic mixture</li> <li>Identify various heavy metals as well as inorganic compounds which leads to a safe labor: environment.</li> </ul> </li> <li><b>1. List of Experiments</b> Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight pecies (four anions and four cations, excluding insoluble salts) out of the following: Cations : NH<sub>4</sub><sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup> Anions : CO3<sup>2-</sup>, S<sup>2-</sup>, SO2<sup>-</sup>, SO3<sup>-</sup>, NO3<sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, L<sup>-</sup>, NO3<sup>-</sup>, SO4<sup>2-</sup>, PO4<sup>3-</sup>, BO3<sup>-3-</sup>, C2<sup>-</sup>, Component <b>Attributes: Attribute: Attribu</b></li></ul>	inorganic m	ixtures	or the racininean		minicient	cation	is and ann	
<ul> <li>To explain the microanalysis techniques for the identification of various heavy metals.</li> <li>To explain the microanalysis techniques for the identification of various heavy metals.</li> <li><b>0. Course Outcomes (COs):</b></li> <li>Jpon successful completion of this course, the student will be able to: <ul> <li>Demonstrate the knowledge of separation and determination of the components in an inorq mixture</li> <li>Predict the quality of any inorganic mixture</li> <li>Identify various heavy metals as well as inorganic compounds which leads to a safe labor: environment.</li> </ul> </li> <li><b>1. List of Experiments</b> <ul> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight pecies (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>Cations : NH<sub>4</sub>*, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup> Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-</sup>, SO<sub>2</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, F, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>-2</sup>, PO<sub>4</sub><sup>-3</sup>, BO<sub>3</sub><sup>-3</sup>, C<sub>2</sub><sup>-1</sup></li> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> </ul> </li> <li><b>2. Brief Description of self-learning / E-learning component</b> <ul> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-</li> <li>nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9F</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-</li> <li>nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6_7_and 8_inorganic_qualitative_analysis_acidic</li> </ul> </li> </ul>	2. To explain s	pecific properties of c	vations and anions					
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<ul> <li>environment.</li> <li>11. List of Experiments</li> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight species (four anions and four cations, excluding insoluble salts) out of the following: Cations : NH<sub>4</sub><sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup> Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-</sup>, S<sub>2</sub>O<sub>3</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, Γ, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sub>2</sub><sup>-</sup></li> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> <li>12. Brief Description of self- learning / E-learning component</li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SILE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ94</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjADegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex_6_7_and 8_iorganic_qualitative_analysis_acidic</li> </ul>	4. Perform the	qualitative analysis	of inorganic com	pounds	which	leads 1	to a safe	laborato
<ul> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight pecies (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>Cations : NH<sub>4</sub><sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup></li> <li>Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-</sup>, S<sub>2</sub>O<sub>3</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, Γ, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sub>2</sub><sup>2-</sup></li> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> <li><b>2. Brief Description of self- learning / E-learning component</b></li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SILE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9J</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=http%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex_6_7_and 8inorganic_qualitative_analysis_acidic</li> </ul>	environment	•						
<ul> <li>Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than eight pecies (four anions and four cations, excluding insoluble salts) out of the following:</li> <li>Cations : NH<sub>4</sub><sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup></li> <li>Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-</sup>, S<sub>2</sub>O<sub>3</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, l<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sub>2</sub><sup>-</sup></li> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> <li><b>2. Brief Description of self- learning</b> / <b>E-learning component</b></li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SILE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda.2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9J</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIBBAC&amp;url=http%3A%2F%2Fwww.kau.edu.sa% ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjAFegOIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6_7_and 8inorganic_qualitative_analysis_acidic</li> </ul>	1. List of Expe	eriments						
pecies (four anions and four cations, excluding insoluble salts) out of the following: Cations : NH4 <sup>+</sup> , Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , Ni <sup>2+</sup> , Mn <sup>2+</sup> , Zn <sup>2+</sup> , Ba <sup>2+</sup> , Sr <sup>2+</sup> , Ca <sup>2+</sup> , K <sup>+</sup> Anions : CO <sub>3</sub> <sup>2-</sup> , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <sup>-</sup> , Br <sup>-</sup> , I <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , PO <sub>4</sub> <sup>3-</sup> , BO <sub>3</sub> <sup>3-</sup> , C <sub>2</sub> <sup>-</sup> (Spot tests and flame tests should be carried out wherever feasible) 2. Brief Description of self- learning / E-learning component https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&usg=AOvVaw2UQZFzj2vPJk2kgTohZ94 https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=6&cad=rja&uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex_6_7_and 8inorganic_qualitative_analysis_acidic_		litative analysis (usin						
<ul> <li><sup>2</sup>ations : NH4<sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup> Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-</sup>, SO<sub>2</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, Γ, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sub>2</sub></li> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> <li><b>2. Brief Description of self- learning</b> / <b>E-learning component</b></li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SI LE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9k</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6 7 and 8 inorganic qualitative analysis acidic</li> </ul>	Semi-micro qua	many canarysis (usin,	g H <sub>2</sub> S or other meth	ods) of	mixture	s - not i	more than	eight ior
<ul> <li>Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>2</sub><sup>-</sup>, SO<sub>2</sub><sup>-</sup>, SO<sub>2</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, l<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sub>2</sub></li> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> <li><b>2. Brief Description of self- learning</b> / <b>E-learning component</b></li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SILE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9k</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex_6_7_and 8_inorganic_qualitative_analysis_acidic_</li> </ul>	Semi-micro qua pecies (four ani	ions and four cations,	g H <sub>2</sub> S or other meth excluding insoluble	ods) of salts) of	mixture out of the	s - not i e follov	more than oving:	eight ior
<ul> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> <li>2. Brief Description of self- learning / E-learning component</li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SILE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda.2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9k</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa%Files%2F0017486%2FSubjects%2Fex_6_7_and_8_inorganic_qualitative_analysis_acidic</li> </ul>	Semi-micro qua pecies (four ani Cations : NH4 <sup>+</sup> ,	ions and four cations, $Pb^{2+}$ , $Bi^{3+}$ , $Cu^{2+}$ , $Cd^{2+}$	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N	ods) of e salts) o Ni <sup>2+</sup> , Mn	mixture out of the n <sup>2+</sup> , Zn <sup>2+</sup>	s - not	more than o ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> .	eight ior K <sup>+</sup>
<ul> <li>(Spot tests and flame tests should be carried out wherever feasible)</li> <li>2. Brief Description of self- learning / E-learning component</li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SILE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda.2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9k</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa%Files%2F0017486%2FSubjects%2Fex_6_7_and_8_inorganic_qualitative_analysis_acidic_and_particle.</li> </ul>	Semi-micro qua pecies (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup>	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl	ods) of e salts) o Ni <sup>2+</sup> , Mn	mixture out of the $n^{2+}$ , $Zn^{2+}$	s - not i e follow, $Ba^{2+}$ , s $SO_4^{2-}$ ,	more than $c$ ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO	eight ior K <sup>+</sup>
<ul> <li>2. Brief Description of self- learning / E-learning component</li> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SILE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda.2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9k. https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa%ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa%Files%2F0017486%2FSubjects%2Fex_6_7_and_8_inorganic_qualitative_analysis_acidic_anaaaaaaaaaaaaaaaaaaaaaa</li></ul>	Semi-micro qua pecies (four an Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup>	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl	ods) of e salts) o Ni <sup>2+</sup> , Mn -, Br <sup>-</sup> , I <sup>-</sup>	mixtures out of the $1^{2+}$ , $Zn^{2+}$ , $T$ , $NO_3^-$ ,	s - not i e follow, $Ba^{2+}$ , s $SO_4^{2-}$ ,	more than eving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3	eight ior K <sup>+</sup> 3 <sup>3-</sup> , C <sub>2</sub> O4
<ul> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SILE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9k</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex_6_7_and_8_inorganic_qualitative_analysis_acidic_</li> </ul>	Semi-micro qua pecies (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , $S^{2-}$ , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N and flame tests should	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , M O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <sup>2+</sup> l be carried out whe	ods) of e salts) c Ni <sup>2+</sup> , Mn , Br <sup>-</sup> , I erever fe	mixtures out of the $1^{2+}$ , $Zn^{2+}$ , $NO_3^-$ , easible)	s - not r e follow, $Ba^{2+}$ , s $SO_4^{2-}$ ,	more than e ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3	eight ior K <sup>+</sup> 3 <sup>3-</sup> , C <sub>2</sub> O4
<ul> <li>https://www.academia.edu/10186454/SEMI_MICRO_QUALITATIVE_ANALYSIS_OF_SILE_INORGANIC_SALT</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda.2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ9k</li> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa%Files%2F0017486%2FSubjects%2Fex_6_7_and_8_inorganic_qualitative_analysis_acidic_acidacidacidacidacidacidacidacidacidacid</li></ul>	Semi-micro qua pecies (four ani Cations : $NH_4^+$ , Anions : $CO_3^{2-}$ (Spot tests <b>2. Brief Descr</b>	ions and four cations, $Pb^{2+}$ , $Bi^{3+}$ , $Cu^{2+}$ , $Cd^{2+}$ , $S^{2-}$ , $SO_2^{-}$ , $S_2O_3^{2-}$ , N and flame tests should <b>ption of self- learnin</b>	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <u>1</u> be carried out whe ig / <b>E-learning con</b>	ods) of e salts) of Ni <sup>2+</sup> , Mn -, Br-, I erever fe	mixture: but of the $1^{2+}$ , $Zn^{2+}$ $\overline{7}$ , $NO_3^{-}$ , easible)	s - not r e follow , Ba <sup>2+</sup> , SO $4^{2-}$ ,	more than e ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3	eight ior K <sup>+</sup> 5 <sup>3-</sup> , C <sub>2</sub> O4
LE_INORGANIC_SALT https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=& ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&usg=AOvVaw2UQZFzj2vPJk2kgTohZ9k https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=6&cad=rja&uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6 7 and 8 inorganic qualitative analysis_acidic	Semi-micro qua species (four ani Cations : $NH_4^+$ , Anions : $CO_3^{2-}$ (Spot tests <b>2. Brief Descri</b>	ions and four cations, $Pb^{2+}$ , $Bi^{3+}$ , $Cu^{2+}$ , $Cd^{2+}$ , $S^{2-}$ , $SO_2^{-}$ , $S_2O_3^{2-}$ , N and flame tests should iption of self- learning	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Ch d be carried out whe og / <b>E-learning con</b>	ods) of e salts) o Ni <sup>2+</sup> , Mn -, Br-, I erever fe ponent	mixture: but of the $r^{2+}$ , $Zn^{2+}$ , $r^{-}$ , $NO_3^{-}$ , casible)	s - not i e follow, $Ba^{2+}$ , $SO_4^{2-}$ ,	more than e ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3	eight ior K <sup>+</sup> 3 <sup>3-</sup> , C <sub>2</sub> O <sub>4</sub>
<ul> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=4&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&amp;url=http%3A%2F%2Fwww.kchn.pg.gda.2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&amp;usg=AOvVaw2UQZFzj2vPJk2kgTohZ94.https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8ed=2ahUKEwiGz-nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa%Files%2F0017486%2FSubjects%2Fex.67and8_inorganic_qualitative_analysis_acidic_</li> </ul>	Semi-micro qua species (four ani Cations : $NH_4^+$ , Anions : $CO_3^{2-}$ (Spot tests <b>2. Brief Descri</b> . https://www	ions and four cations, $Pb^{2+}$ , $Bi^{3+}$ , $Cu^{2+}$ , $Cd^{2+}$ , $S^{2-}$ , $SO_2^{-}$ , $S_2O_3^{2-}$ , N and flame tests should iption of self- learnin .academia.edu/101864	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl d be carried out whe og / <b>E-learning con</b>	ods) of e salts) of Ni <sup>2+</sup> , Mn -, Br <sup>-</sup> , I <sup>-</sup> erever fe iponent	mixture: but of the $1^{2+}$ , $Zn^{2+}$ $7$ , $NO_3^{-}$ , casible) t	s - not i e follow, $Ba^{2+}$ , s $SO_4^{2-}$ ,	more than $e^{1}$ ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO <sub>4</sub> <sup>3-</sup> , BO <sub>3</sub>	eight ior $K^+$ $S^{3^-}$ , C <sub>2</sub> O <sub>4</sub>
ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&usg=AOvVaw2UQZFzj2vPJk2kgTohZ9k https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=6&cad=rja&uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6 7 and 8 inorganic qualitative analysis_acidic	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests <b>2. Brief Descri</b> . https://www LE INORG	ions and four cations, $Pb^{2+}$ , $Bi^{3+}$ , $Cu^{2+}$ , $Cd^{2+}$ , $S^{2-}$ , $SO_2^{-}$ , $S_2O_3^{2-}$ , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC SALT	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <sup>2+</sup> l be carried out whe g / <b>E-learning con</b> $\frac{154}{SEMI_MICRO}$	ods) of e salts) c Vi <sup>2+</sup> , Mn , Br <sup>-</sup> , I erever fe ponent _QUAL	mixture: out of the 2 <sup>2+</sup> , Zn <sup>2+</sup> , -, NO <sub>3</sub> <sup>-</sup> , easible) t	s - not i e follow, $Ba^{2+}$ , $SO_4^{2-}$ , $SO_4^{2-}$ , $VE_AN$	more than 6 ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3	eight ior K <sup>+</sup> 3 <sup>3-</sup> , C <sub>2</sub> O <sub>4</sub>
nxrKziAhWhheYKHVkEC_4QFjADegQIAxAC&url=http%3A%2F%2Fwww.kchn.pg.gda. 2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&usg=AOvVaw2UQZFzj2vPJk2kgTohZ9F . https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=6&cad=rja&uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6 7 and 8 inorganic qualitative analysis_acidic	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests 2. Brief Descri https://www LE_INORG.	ions and four cations, $Pb^{2+}$ , $Bi^{3+}$ , $Cu^{2+}$ , $Cd^{2+}$ , $S^{2-}$ , $SO_2^{-}$ , $S_2O_3^{2-}$ , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC_SALT .google.co.in/url?sa=t	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <sup>-</sup> <u>1</u> be carried out whe og / <b>E-learning con</b> $454/SEMI_MICRO$	ods) of e salts) o Ni <sup>2+</sup> , Mr -, Br <sup>-</sup> , I erever fe <b>ponent</b> _QUAL	mixture: put of the $^{2^+}$ , $Zn^{2^+}$ , $^-$ , $NO_3^-$ , casible) t LITATIV e=web&	s - not i e follow, $Ba^{2+}$ , so $SO_4^{2-}$ , $VE_AN$	more than a ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3 ALYSIS_C	eight ior $K^+$ $B^{3^-}$ , C <sub>2</sub> O <sub>4</sub> DF_SIM pact=8 <i>&amp;</i>
2Fdidactics%2Fskrypt_lab%2Flab_gtm_salts.pdf&usg=AOvVaw2UQZFzj2vPJk2kgTohZ9l <u>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6_7_and_8inorganic_qualitative_analysis_acidic_</u>	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests <b>2. Brief Descri</b> . https://www LE_INORG. 2. https://www ed=2ahUKE	ions and four cations, $Pb^{2+}$ , $Bi^{3+}$ , $Cu^{2+}$ , $Cd^{2+}$ , $S^{2-}$ , $SO_2^-$ , $S_2O_3^{2-}$ , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC_SALT .google.co.in/url?sa=t wiGz-	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <u>1</u> be carried out whe ng / <b>E-learning con</b> 454/SEMI_MICRO &rct=j&q=&esrc=s	ods) of e salts) of Ni <sup>2+</sup> , Mn -, Br <sup>-</sup> , I <sup>-</sup> erever fe <b>ponent</b> _QUAL &sourc	mixture: but of the l <sup>2+</sup> , Zn <sup>2+</sup> , r, NO <sub>3</sub> <sup>-</sup> , easible) t LITATIV e=web&	s - not n e follow, $Ba^{2+}$ , s $SO_4^{2-}$ , $VE_AN$	more than o ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3 ALYSIS_0 ccad=rja&u	eight ior $K^+$ $S^{3^-}$ , C <sub>2</sub> O <sub>4</sub> $DF_SIM$ hact=8&
<ul> <li>https://www.google.co.in/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=6&amp;cad=rja&amp;uact=8 ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&amp;url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6 7 and 8 inorganic qualitative analysis_acidic</li> </ul>	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests <b>2. Brief Descri</b> https://www LE_INORG. 2. https://www ed=2ahUKE nxrKziAhW	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC_SALT .google.co.in/url?sa=t wiGz- hheYKHVkEC_4OFi	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <sup>2+</sup> d be carried out whe ig / <b>E-learning con</b> $454/SEMI_MICRO$ &rct=j&q=&esrc=s ADegOIAxAC&ur	iods) of e salts) of Vi <sup>2+</sup> , Mn , Br <sup>-</sup> , I erever fe <b>ponent</b> _QUAL s&sourc	mixture: put of the $2^{2+}$ , $Zn^{2+}$ , $7$ , $NO_3^-$ , easible) t LITATIV e=web& $3A^{0/2}E^{0}$	s - not i e follov , Ba <sup>2+</sup> , SO4 <sup>2+</sup> , SO <sup>2</sup>	more than e ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3 ALYSIS_C ccad=rja&u	eight ior $K^+$ $B^{3^-}$ , C <sub>2</sub> O <sub>4</sub> $DF_SIM$ hact=8&
ed=2ahUKEwiGz- nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6_7_and_8inorganic_qualitative_analysis_acidic_	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests 2. Brief Descri b. https://www LE_INORG 2. https://www ed=2ahUKE nxrKziAhW 2Fdidactics <sup>9</sup>	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC_SALT .google.co.in/url?sa=t wiGz- hheYKHVkEC_4QFj 62Fskrypt_lab%2Flab	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Ch <u>1 be carried out whe</u> og / E-learning con 454/SEMI_MICRO &rct=j&q=&esrc=s ADegQIAxAC&ur	ods) of e salts) of Ni <sup>2+</sup> , Mr -, Br <sup>-</sup> , I erever fe <b>ponent</b> _QUAL & sourc = http%	mixture: put of the $2^{2+}$ , $Zn^{2+}$ , $r$ , $NO_{3}^{-}$ , casible) t LITATIV e=web& $3A\%2F^{0}$ Vaw210	s - not r e follow, $Ba^{2+}$ , s $SO_4^{2-}$ , $VE_AN$ ccd=4& %2Fwv	more than e ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3 ALYSIS_C cad=rja&u vw.kchn.pg	eight ion $K^+$ $B^{3^-}$ , C <sub>2</sub> O <sub>4</sub> DF_SIM hact=8& g.gda.pl <sup>9</sup> ph70th
nxrKziAhWhheYKHVkEC_4QFjAFegQIBBAC&url=https%3A%2F%2Fwww.kau.edu.sa% Files%2F0017486%2FSubjects%2Fex. 6_7_and_8inorganic_qualitative_analysis_acidic_	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests <b>12. Brief Descri</b> I. https://www LE_INORG. 2. https://www ed=2ahUKE nxrKziAhW 2Fdidactics%	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC_SALT .google.co.in/url?sa=t wiGz- hheYKHVkEC_4QFj %2Fskrypt_lab%2Flab google.co.in/url?sa=t	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <u>1</u> be carried out whe og / <b>E-learning con</b> 454/SEMI_MICRO &rct=j&q=&esrc=s ADegQIAxAC&ur o_gtm_salts.pdf&us &rct=i&q=&esrc=s	iods) of e salts) of Ni <sup>2+</sup> , Mn -, Br <sup>-</sup> , I <sup>-</sup> erever fe iponent _QUAL & sourc l=http% g=AOv	mixture: put of the put of t	s - not i e follov , Ba <sup>2+</sup> , SO4 <sup>2+</sup> , SO <sup>2+</sup>	more than o ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3 ALYSIS_0 cad=rja&u vw.kchn.pg vPJk2kgTo cad=ria for	eight ion $K^+$ $DF_SIM$ $DF_SIM$ act=8&c g.gda.pl% bhZ9kh act=8
Files%2F0017486%2FSubjects%2Fex. 6 7 and 8 inorganic qualitative analysis acidic	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests <b>12. Brief Descri</b> L. https://www LE_INORG. 2. https://www ed=2ahUKE nxrKziAhW 2Fdidactics% 3. <u>https://www</u> ed=2ahUKE	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC_SALT .google.co.in/url?sa=t wiGz- hheYKHVkEC_4QFj %2Fskrypt_lab%2Flab .google.co.in/url?sa=t wiGz-	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <sup>-</sup> <u>1</u> be carried out whe g / <b>E-learning con</b> 454/SEMI_MICRO &rct=j&q=&esrc=s ADegQIAxAC&ur b_gtm_salts.pdf&us &rct=j&q=&esrc=s	iods) of e salts) of Vi <sup>2+</sup> , Mn -, Br <sup>-</sup> , I <sup>-</sup> erever fe <b>ponent</b> _QUAL &sourc l=http% g=AOv &sourc	mixture: put of the put of t	s - not r e follow , Ba <sup>2+</sup> , $SO_4^{2-}$ , SO <sub>4</sub> <sup>2-</sup> , VE_AN ccd=4& %2Fwv QZFzj2 ccd=6&	more than oving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3 ALYSIS_C cad=rja&u vw.kchn.pg vPJk2kgTo cad=rja&u	eight ion K <sup>+</sup> 3 <sup>3-</sup> , C <sub>2</sub> O <sub>4</sub> DF_SIM act=8& g.gda.pl% phZ9kh act=8&
norganic quantative analysis acidic	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests <b>12. Brief Descri</b> I. https://www LE_INORG 2. https://www ed=2ahUKE nxrKziAhW 2Fdidactics% 5. <u>https://www ed=2ahUKE</u> nxrKziAbW	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC_SALT .google.co.in/url?sa=t wiGz- hheYKHVkEC_4QFj %2Fskrypt_lab%2Flab .google.co.in/url?sa=t wiGz- hheYKHVkEC_4QFj	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Ch d be carried out whe og / E-learning con 454/SEMI_MICRO &rct=j&q=&esrc=s ADegQIAxAC&ur o_gtm_salts.pdf&us &rct=j&q=&esrc=s	ods) of e salts) of vi <sup>2+</sup> , Mn -, Br <sup>-</sup> , I erever fe <b>ponent</b> _QUAL &sourc l=http% g=AOv &sourc	mixture: put of the put of t	s - not i e follov , Ba <sup>2+</sup> , $\frac{1}{2}$ SO4 <sup>2-</sup> , $\frac{1}{2}$ ZCd=4& $\frac{1}{2}$ ZFzj2 Cd=6&	more than e ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3 ALYSIS_C cad=rja&u vw.kchn.pg vPJk2kgTe cad=rja&u	eight ior $K^+$ $B^{3^-}$ , $C_2O_4$ $DF_SIM$ $act=8\&^{10}$ $g.gda.pl^9$ bhZ9kh $act=8\&^{10}$ $act=8\&^{10}$
	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests <b>2. Brief Descri</b> https://www LE_INORG https://www ed=2ahUKE nxrKziAhW 2Fdidactics% https://www ed=2ahUKE nxrKziAhW Eiles%2E00	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC_SALT .google.co.in/url?sa=t wiGz- hheYKHVkEC_4QFj 62Fskrypt_lab%2Flab .google.co.in/url?sa=t wiGz- hheYKHVkEC_4QFj 17486%2FSubject <sup>20</sup>	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , P O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <sup>-</sup> <u>1 be carried out whe</u> og / E-learning con 454/SEMI_MICRO &rct=j&q=&esrc=s ADegQIAxAC&url o_gtm_salts.pdf&us &rct=j&q=&esrc=s <u>AFegQIBBAC&amp;url</u> <u>Prev 6 7 and 8</u>	iods) of e salts) of Ni <sup>2+</sup> , Mn , Br <sup>-</sup> , I <sup>-</sup> erever fe <b>ponent</b> _QUAL &sourc =http% g=AOv &sourc =https?	mixture: put of the put of t	s - not r e follov , Ba <sup>2+</sup> , $\frac{1}{2}$ SO4 <sup>2-</sup> , $VE_AN$ ccd=4& %2Fwv QZFzj2 ccd=6& 5%2Fw	more than e ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3 ALYSIS_C .cad=rja&u vw.kchn.pg vPJk2kgTe .cad=rja&u ww.kau.ed	eight ior $K^+$ $B^{3^-}$ , $C_2O_4$ $DF_SIM$ $act=8\&^{cr}$ g.gda.pl% bhZ9kh $act=8\&^{cr}$ $act=8\&^{cr}$ bhZ9kh $act=8\&^{cr}$
	Semi-micro qua species (four ani Cations : NH4 <sup>+</sup> , Anions : CO3 <sup>2-</sup> (Spot tests <b>2. Brief Descri</b> https://www LE_INORG. https://www ed=2ahUKE nxrKziAhW 2Fdidactics% https://www ed=2ahUKE nxrKziAhW Files%2F00	ions and four cations, Pb <sup>2+</sup> , Bi <sup>3+</sup> , Cu <sup>2+</sup> , Cd <sup>2+</sup> , S <sup>2-</sup> , SO <sub>2</sub> <sup>-</sup> , S <sub>2</sub> O <sub>3</sub> <sup>2-</sup> , N and flame tests should iption of self- learnin .academia.edu/101864 ANIC_SALT .google.co.in/url?sa=t wiGz- hheYKHVkEC_4QFj &2Fskrypt_lab%2Flat .google.co.in/url?sa=t wiGz- hheYKHVkEC_4QFj <u>17486%2FSubjects%2</u>	g H <sub>2</sub> S or other meth excluding insoluble , Fe <sup>3+</sup> , Al <sup>3+</sup> , Co <sup>2+</sup> , N O <sub>3</sub> <sup>-</sup> , CH <sub>3</sub> COO <sup>-</sup> , Cl <u>1</u> be carried out whe og / <b>E-learning con</b> 454/SEMI_MICRO &rct=j&q=&esrc=s ADegQIAxAC&url o_gtm_salts.pdf&us &rct=j&q=&esrc=s <u>AFegQIBBAC&amp;url</u> <u>2Fex. 6_7_and_8</u>	iods) of e salts) of vi <sup>2+</sup> , Mn r, Br <sup>-</sup> , I <sup>-</sup> erever fe <b>ponent</b> QUAL &sourc =http% g=AOv &sourc	mixture: put of the $2^{2+}$ , $Zn^{2+}$ , $7$ , $NO_{3}^{-}$ , easible) t UTATIV e=web& $3A\%2F^{0}$ Vaw2U( e=web& 63A%2F 63A%2F	s - not r e follow , Ba <sup>2+</sup> , SO4 <sup>2-</sup> , SO4 <sup>2-</sup> , $VE_AN$ $VE_AN$ xcd=4& $2VE_VV$ QZFzj2 xcd=6& S%2Fw itative	more than e ving: Sr <sup>2+</sup> , Ca <sup>2+</sup> , PO4 <sup>3-</sup> , BO3 ALYSIS_C cad=rja&u vw.kchn.pg vPJk2kgTe .cad=rja&u ww.kau.ed analysis_a	eight ior K <sup>+</sup> 3 <sup>3-</sup> , C <sub>2</sub> O <sub>4</sub> DF_SIM act=8& g.gda.pl% bhZ9kh act=8& u.sa%2F cidic_ra

# cal.pdf&usg=AOvVaw3qS6PTSyRaV7eZdao2PXX7

### 13. Books Recommended

- Vogel's Qualitative Inorganic Analysis, Svehla, G., Pearson Education, 2012, ISBN-13: 978-8131773710
- Vogel's Quantitative Chemical Analysis, Mendham, J., Pearson, 2009, ISBN-13: 978-0582226289



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3.		e	Physical C	hemis	stry Practical-II	L		Т	P
4	<b>Course Code</b>		17060205			0		0	4
1. Type of Course (use tick mark)		se (us	se tick man	rk)	Core (🖌	DSE ()		SI	EC ()
	Pre-	B Sc	(He	(and	6 Frequency	Even	Odd	Fither	Erroma
•	requisite	Cher	nistrv	or	(use fick marks)	Even		Sem ()	Sem ()
	(if any)	B.Sc	. (1	Non	(use tiek marks)				Sen ()
		Med	ical/Medic	al)					
	<b>Total Number</b>	r of L	ectures, T	utori	als, Practicals				
le	ctures = Nil				Tutorials = Nil	Pra	actical	= 78	
	<b>Course Descr</b>	iption	1:			1		10	
h	is Course will	enab	le the post	t grad	luate students to learn	various	notenti	ometric ti	tration at
ar	nds on experien	nce of	using pote	ention	neters. Students will als	so be wo	rk on re	fractomet	er and ah
0	learn other exp	erime	ntal studie	s on o	chemical kinetic and the	ermocher	nistry.	This cours	e will als
iv	e a platform to	devel	op method	s of a	nalysis of various prope	erties of 1	iquids.	This could	o will all
	Course Obje	ctives	:						
h	e objectives of	this co	ourse are:						
	To explain the	princ	iple of pote	entior	netric titration of variou	ıs system	S.		
	To explain the	conce	epts of ther	moch	emistry and refractome	trv.			
	To explain the	hand	ling of inst	rume	nts such as the refracton	neter.			
	To learn the ki	inetics	s of various	react	tions.				
0.	<b>Course Outco</b>	mes (	(COs):						
•	Describe appli	cation	- <b>F</b> 41						
1.	Determine the	illing of kineti	of instrume	chem ents su us rea	istry in determination o uch as the refractometer actions.	f heat of	neutral	ization.	1.00
1.	Determine the List of Experi	iling o kineti ment	of instrume ics of vario s	chem ents su us rea	istry in determination o uch as the refractometer actions.	f heat of	neutral	ization.	
1.	Determine the List of Experi Potentiometry	dling o kineti ment	of instrume ics of vario s	chem ents su us rea	istry in determination o uch as the refractometer actions.	f heat of	neutral	ization.	
1.	Determine the List of Experi Potentiometry i. HC	dling o kineti ment V l vs N	l of thermo of instrume ics of vario s laOH titrati	chem ents su us rea ion.	istry in determination o uch as the refractometer actions.	f heat of	neutral	ization.	
1.	Potentiometry i. HC ii. Oxa iii. CH	dling o kineti ment l vs N alic ac	a of thermo of instrume ics of vario s laOH titrati cid NaOH t DH vs NaO	ion.	istry in determination o uch as the refractometer actions.	f heat of	neutral	ization.	
1.	Potentiometry i. HC ii. Oxa iii. CH Refractometry	dling o kineti ment l vs N alic ac 3 COC	a of thermo of instrume ics of vario s laOH titrati cid NaOH t DH vs NaO	ion. itratic	istry in determination o uch as the refractometer actions.	f heat of	neutral	ization.	
1.	Potentiometry i. HC ii. Oxa iii. CH Refractometry i.To detern	dling o kineti ment l vs N alic ac 3 COC	aOH titrati ics of vario s laOH titrati cid NaOH t DH vs NaO nolar refrac	ion. itratic	istry in determination o uch as the refractometer actions.	f heat of	neutral	ization.	
1.	Chow the hand Determine the List of Experi Potentiometry i. HC ii. Oxa iii. CH Refractometry i.To determ ii. To determ	dling of kineti ment 1 vs N alic ac 3 COC nine r	a of thermo of instrume ics of vario s laOH titrati cid NaOH t DH vs NaO molar refrace percentage	ion. itratic ctivity	istry in determination o uch as the refractometer actions. on. ration. y of the given liquid. osition of liquids in the	f heat of	neutral	ization.	
1.	Potentiometry i. HC ii. Oxa iii. CH Cefractometry i.To detern iii.To detern iii.To detern	dling c kineti ment l vs N alic ac 3 COC nine r nine p nine c	aOH titrati ics of vario s laOH titrati cid NaOH t DH vs NaO molar refrace concentratic	ion. itratic ctivity comp	istry in determination o uch as the refractometer actions. on. ation. y of the given liquid. osition of liquids in the sugar in a solution.	f heat of	neutral	ization.	
·	Know the hand         Determine the         List of Experi         Potentiometry         i. HC         ii. Oxa         iii. CH         Refractometry         i.To determ         iii.To determ         iii.To determ         iii.To determ	dling o kineti ment ment l vs N alic ac 3 COC nine r nine r nine p nine c tics	aOH titrati ics of vario s laOH titrati cid NaOH t DH vs NaO molar refrace concentratio	ion. itratic H titr comp on of	istry in determination on the as the refractometer actions.	f heat of	neutral	ization.	
1.	Chemical Kinet	dling of kineti ment l vs N alic ac 3 COC nine r nine r nine p nine c tics study	a of thermo of instrume ics of vario s laOH titrati cid NaOH t DH vs NaO molar refrace concentratic kinetics of	ion. itratic ctivity compon of	istry in determination o uch as the refractometer actions. on. ation. y of the given liquid. osition of liquids in the sugar in a solution.	f heat of given bin	neutral	ization.	
1.	Know the hand         Determine the         List of Experi         Potentiometry         i. HC         ii. Oxa         iii. CH         Refractometry         i.To determ         iii.To determ	dling of kineti ment ment l vs N alic ac 3 COC nine r nine r nine p nine c tics study compa	aOH titraticid NaOH titraticid NaOH titraticid NaOH titraticid NaOH to NaO molar refrace concentraticid kinetics of are the rela	ion. itratic H titr comp on of hydro	istry in determination on the as the refractometer actions.	f heat of given bin esence of nd H <sub>2</sub> SO <sub>4</sub>	neutral	ization.	
1.	Know the hand         Determine the         List of Experi         Potentiometry         i. HC         ii. Oxa         iii. CH         Refractometry         i.To determ         iii.To determ	dling of kineti ment ment l vs N alic ac 3 COC nine r nine r nine r nine c tics study compa istry	a of thermo of instrume ics of vario s laOH titraticid NaOH ti DH vs NaO molar refrace concentratic kinetics of are the rela	ion. itratic tivity comp on of hydro tive s	istry in determination on the as the refractometer actions.	f heat of given bin esence of nd H <sub>2</sub> SO4	neutral	ization.	
1. . F	Know the hand Determine the List of Experi Potentiometry i. HC ii. Oxa iii. CH Cefractometry i.To determ ii.To determ iii.To determ iii.To determ iii.To determ iii. To determ iii. To determ chemical Kinet i. To s ii. To s	dling of kineti ment ment l vs N alic ac 3 COO nine r nine r nine r nine c tics study compa istry neat of	a of thermo of instrume ics of vario s laOH titrati cid NaOH t DH vs NaO molar refrace concentratic kinetics of are the rela	ion. itratic ion. itratic itra	istry in determination on the as the refractometer actions.	f heat of given bin esence of nd H <sub>2</sub> SO4	neutral nary mi acid.	ization.	
1.	Know the hand         Determine the         List of Experi         Potentiometry         i. HC         ii. Oxa         iii. CH         Refractometry         i.To determ         iii.To determ         ii.To determ         ii.To determ         ii.To determ         ii.HCl NaO	dling of kineti ment ment l vs N alic ac 3 COC nine r nine r nine r nine r study compa istry neat of	a of thermo of instrume ics of vario s laOH titraticid NaOH ti DH vs NaO molar refrace concentratic kinetics of are the rela	ion. itratic tivity comp on of hydro tive s	istry in determination on the as the refractometer actions.	f heat of given bin esence of nd H <sub>2</sub> SO4	neutral	ization.	
1. . F	Rnow the hand Determine the List of Experi Potentiometry i. HC ii. Oxa iii. CH Refractometry i.To determ ii.To determ iii.To determ iii.To determ iii. To se iii. HCl NaO ii.CH <sub>3</sub> COO	dling of kineti ment nent l vs N alic ac 3 COO nine r nine r nine r nine r nine r study compa istry neat of H OH vs	a of thermo of instrume ics of vario s laOH titrati cid NaOH titrati cid NaOH to NaOH refrace concentratic kinetics of are the rela f neutraliza NaOH	ion. itratic tivity compon of hydro tive s tion c	istry in determination o uch as the refractometer actions. on. ation. y of the given liquid. osition of liquids in the sugar in a solution. olysis of ester in the pre trength of acids (HCl ar of the followings:-	f heat of given bin esence of nd H <sub>2</sub> SO4	neutral nary mi acid.	ization.	
	Know the hand         Determine the         List of Experi         Potentiometry         i. HC         ii. Oxa         iii. CH         Refractometry         i.To determ         iii.To determ         iii.To determ         iii. To determ         iii. Ch addition of h         i.HCl NaO         ii.Oxalic ac	dling of kineti ment ment l vs N alic ac 3 COC nine r nine r nine r nine r study compa istry neat of H H vs id Na	a of thermo of instrume ics of vario s laOH titraticid NaOH ti DH vs NaO molar refrace concentratic kinetics of are the rela f neutraliza NaOH OH	ion. itratic H titr ctivity comp on of hydro tive s	istry in determination o uch as the refractometer actions. on. ration. y of the given liquid. osition of liquids in the sugar in a solution. olysis of ester in the pre trength of acids (HCl ar of the followings:-	f heat of given bin esence of nd H <sub>2</sub> SO4	neutral	ization.	

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- 1. https://nptel.ac.in/courses/103108100/37
- 2. https://youtu.be/w-YIzLQwtUk
- 3. https://youtu.be/N\_zX19n9SKA
- 4. https://youtu.be/UNvAZVaFLLs

- 1. Khosla, B.D., V.C. Garg and A.Gulati. Senior Practical Physical Chemistry.
- 2. Thawale, A. and P. Mathur. Experimental Physical Chemistry.
- 3. Vishwanatha, B. and P. S Raghav. Practical Physical Chemistry.
- 4. Sindhu, P.S. Practical in Physical Chemistry.

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2. Course Name	Organic Chemistr	y Practical-II	L	1	Г	Р
3. Course Code	17060206		0	(	0 0	6
4. Type of Cours	e (use tick mark)	Core (	D	SE ()	0 SEC ()	
5. Pre- requisite (if any)	B.Sc. (Hons) Chemistry or B.Sc. (Non Medical/Medical)	6. Frequency (use tick mark	Even ()	Odd ()	Either Sem ()	Every Sem ()
7. Total Number	of Lectures, Tutor	ials, Practicals				12
Lectures = Nil		Tutorials = Nil	P	ractical =	= 78	5. 1. 5.
8. Course Descri	ption:					
(IR, NMR & Mass) groups, reaction mo	onitoring, their separ	cal methods. It inclu ration and purification	compounds ides synthe on.	using sp sis of der	ivatives of	ic metho f functior
9. Course Objec	tives:					1
2. To study the ch 3. To find out the 4. To learn monitor 10. Course Outcor By the end of this c	aracterization of cor methods for their se oring of the chemica <b>nes (COs):</b> ourse, students shou	npounds by using IF paration and purifica l reaction. Ild be able to:	R, NMR & ation techni	Mass ques.		
<ol> <li>Parlote organic</li> <li>Perform the star</li> <li>Execute the che</li> </ol>	ndard techniques use mical reactions and	and competent mani ed in practical organ monitoring using TI	her. ic chemistr LC.	у.		
11. List of Experim	nents	ized compounds.				
<ul> <li>i. Structural deter Mass) followed Note: Students</li> <li>ii. Analytical and extracts and use</li> <li>iii. Separation of chromatograph Note: Students compounds).</li> </ul>	ermination of organ l by chemical metho s need to analyze and l preparative TLCs e of different develo mixture (mixture y. need to perform an	tic compounds usin ods (Monofunctional t least 5 compounds (mixtures contain oping agents) s containing two t least 5 experiment	g spectros and Bifund s. ing three or three s (each of the	copic me etional co or more compou <b>mixture c</b>	ethods (IR mpounds) compound nds) usin of 2 or 3	, NMR ds, natur g colun
12. E-learning con	nponent					
1. <u>https://www.yo</u> 2. <u>https://www.yo</u> 3. https://www.yo	utube.com/watch?v utube.com/watch?v utube.com/watch?v	=qdmKGskCyh8 =UmWMlKJAdSk =kPx6BlJj5DU				
3. Books Recomm	ended					
. Chapman and H	all, 5th edition, Tex	tbook of Practical O	rganic Che	mistry, 19	996.	
1. <u>https://www.yo</u> 2. <u>https://www.yo</u> 3. https://www.yo <b>3. Books Recomm</b> 1. Chapman and H	entube.com/watch?v outube.com/watch?v outube.com/watch?v ended fall, 5th edition, Tex	=qdmKGskCyh8 =UmWMIKJAdSk =kPx6BIJj5DU tbook of Practical O	rganic Che	mistry, 19	996.	

- 2. Nicolas Bogliotti, RobaMoumné ,Multi- step Organic Synthesis, A Guide through Experiments,Dec 2017.
- 3. Brian S, Furniss, Vogel's Textbook of Practical Organic chemistry, 5th edition,.
- 4. Tatchell, A. R. Vogel's Textbook of Practical Organic Chemistry. John Wiley.

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2. Course Nan	e Research Methode	ology and Technical W	Vriting	$\mathbf{L}$	T	Р
3. Course Code	17060207			2	0	0
4. Type of Cou	rse (use tick mark)	Core ()	DSI	ΕO	SEC ()	
5. Pre- requisite (if any)	B.Sc. (Hons) Chemistry or B.Sc. (Non Medical/Medical)	6. Frequency (use tick marks)	Even ()	Odd ()	Either Sem ()	Every Sem ()
7. Total Numb	er of Lectures, Tutori	als, Practical				
Lectures = 26		Tutorials = Nil	Pra	etical =	= Nil	
8. Course Desc	ription:			1		
quantitative and conducting resea measures. Ethica	qualitative research methods a l, legal, social & scient	ethods. The need for rassociated with condu- ific issues in research	research a cting scho are also i	basic of and liter olarly re ncluded	concepts er rature revie esearch, lab	w, steps in safety an
9. Course Obj	ectives:					
<ol> <li>To understand</li> <li>To identify at the select and</li> <li>To organize</li> </ol>	nd some basic concepts appropriate research top d define appropriate res and conduct research i	s of research and its me pics search problem and pa n a more appropriate r	ethodolog rameters nanner	gies		
10. Course Outc	omes (COs):					
<ol> <li>Demonstrate</li> <li>Demonstrate</li> <li>Have adequat</li> <li>Express the k</li> <li>Identify, expl</li> </ol>	the course, each stude the knowledge on qual e knowledge on quanti nowledge of research p ain, compare, and prep	itative research technic tative data analysis. processes (reading, eva are the key elements o	ques. luating, a f a resear	and dev och prop	eloping). posal/report	
11. Unit wise de	ailed content					
Unit-1 Num	per of lectures = 15	Title of the unit:Int	roductio	n of Re	esearch Me	thodolog
Introduction and significance of re Research Probler problem, Objecti Literature search	basic concepts in Research, Criteria for good n: Necessity and technic ves of research problem source of information	esearch Methodology: od research & problem iques of defining resea n	Meaning s encoun arch prob	of res tered by lem, Fo	earch, obje v research s ormulation	ectives an cholars. of researc
Unit – 2   Numl	per of lectures = 11	Title of the unit:Re	search D	esign		
Research Design Designs, Design Data Collection a	: Need and features of of experiments and per- nd Validation	of good research design forming experiments.	gn, Basic	e Princi	ples of Ex	perimenta
Unit – 3 Numl	per of lectures = 10	Title of the unit:Et and Lab Safety Me	hical, leg asures	al soci	al, & scien	tific issue
Introduction to F issues in research norms in research Lab Safety Measure	esearch Ethics, Objec h, informed concept, , Ethical Principles. ares: Introduction, Cod	tives in Research Eth Role of ethical comm le of conduct - while e	iics, Ethi nittee. Im ntering ii	cal, leg portant	al social & t to adhere b, while wo	to ethics
Aspana	A	10	The	1	V	

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the chemicals, while disposal of chemicals, Storage and disposal of chemical wastes - aqueous wastes, organic wastes and radioactive wastes, Human contribution to reduce hazardous wastes.

Unit – 4 Nu	mber of lectures = 15	Title of the	unit:Report Writing
-------------	-----------------------	--------------	---------------------

Writing of report: Basic concepts of paper, their writing, review of literature, Concepts of Bibliography and References, significance of report writing, steps of report writing. Presentation of report/paper: Oral, Poster presentation, research paper, review articles, peer reviewed journals

### 12. Brief Description of self learning / E-learning component

- 1. http://www2.ift.ulaval.ca/~chaib/IFT-6001/articles/RMethodology Marzuki 1.pdf
- 2. https://shodhganga.inflibnet.ac.in/bitstream/10603/71970/14/14 chapter%204.pdf
- 3. http://www.tamuc.edu/academics/cvSyllabi/syllabi/201440/40503.pdf

- 1. Blum, Deborah and Mary Knudson, eds. A field guide for science writers: the official guide of the National Association of Science Writers, New York: Oxford University Press, 1997.
- 2. Davis, Martha. Scientific Papers and Presentations. San Diego: Academic Press, 1997.
- 3. Fuscaldo, AA, Erlick, BI, Hindman, B. Laboratory Safety: Theory and Practice. New York: Academic Press, 1980.
- 4. Bajpai, PK. Biological Instrumentation and Methodology. New Delhi: S. Chand & Co. Ltd. 2006.
- 5. CR Kothari, Research Methodology: Methods & techniques, Gaurav Garg. New Age Publishers.

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2. Course Name	Material Chemistry		. ]	Ĺ	Т		Р
3. Course Code	17060208		2	4	0		0
4. Type of Course	(use tick mark)	Core ()		DSE (	<b>v</b> )	SEC ()	
5. Pre-requisite (if any)	B.Sc. (Hons) Chemistry or B.Sc. (Non Medical/Medical)	6. Freque (use marks)	ncy tick	Even (√)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number o	f Lectures, Tutorials, Pr	actical (assu	ming	14 wee	ks of one se	emester)	
Lectures = 26	Tu	torials = Nil	l .	Prac	tical = Nil	100	
8. Course Descript	tion:			1		53	
<ol> <li>The objectives of thi</li> <li>To learn the monopolymers</li> <li>To understand t</li> </ol>	s course are: ost common and importan he atomic-level build-up o	t materials su	uch as	Glasse	s, Ceramics	s, Compos	sites ar
<ol> <li>To learn the pro</li> <li>To learn the imp</li> <li>10. Course Outcom</li> <li>On completion of the</li> <li>Demonstrate the</li> <li>Apply the analytimaterials.</li> </ol>	perties of materials such a portance of ionic conducto es (COs): e course, the student should knowledge of material che ical reasoning for explaining	d be able to: emistry.	iples f	or the a	netic and ele	ectrical pro	of soli
<ol> <li>To learn the pro</li> <li>To learn the imp</li> <li>To learn the imp</li> <li>Course Outcom</li> <li>Completion of the</li> <li>Demonstrate the</li> <li>Apply the analytimaterials.</li> <li>Identify the most</li> <li>Explain the impo</li> <li>Unit wise detailed</li> </ol>	perties of materials such a portance of ionic conducto es (COs): e course, the student should knowledge of material che ical reasoning for explaining common and important m rtance of various properties ed content	d be able to: emistry. ing the principaterials. es of differen	iples f	or the a	netic and electronic-level	ectrical pro	of soli
<ol> <li>To learn the pro</li> <li>To learn the imp</li> <li>To learn the imp</li> <li>Course Outcom</li> <li>On completion of the</li> <li>Demonstrate the</li> <li>Apply the analytimaterials.</li> <li>Identify the most</li> <li>Explain the impo</li> <li>Unit wise detaile</li> <li>Unit-1</li> </ol>	perties of materials such a portance of ionic conducto es (COs): e course, the student should knowledge of material che ical reasoning for explaining common and important mertance of various properties ed content er of lectures = 7	d be able to: emistry. ing the principaterials. es of differen	iples f t types	il, magn	atomic-level erials.	ectrical pro	of sol
<ol> <li>To learn the pro</li> <li>To learn the imp</li> <li>10. Course Outcom</li> <li>On completion of the</li> <li>Demonstrate the</li> <li>Apply the analyt materials.</li> <li>Identify the most</li> <li>Explain the impo</li> <li>Unit-1 Numb</li> <li>Classification of mat materials: electrical</li> <li>Materials: Corrosion</li> </ol>	perties of materials such a portance of ionic conducto es (COs): e course, the student should knowledge of material che ical reasoning for explaining common and important me rtance of various properties ed content er of lectures = 7 Tit erials. Advanced Material , thermal, magnetic and of metals and ceremics, de	d be able to: emistry. ing the prince naterials. es of differen le of the unit s, Future ma l optical pro egradation of	iples f t types t: Intr terials opertie f polyr	or the a of mat	atomic-level atomic-level aerials.	ectrical pro l build-up rials rials. Prop l Degrada	of sol
<ol> <li>To learn the pro</li> <li>To learn the imp</li> <li>10. Course Outcom</li> <li>On completion of the</li> <li>Demonstrate the</li> <li>Apply the analyt materials.</li> <li>Identify the most</li> <li>Explain the impo</li> <li>11. Unit wise detaile</li> <li>Unit-1 Numb</li> <li>Classification of materials: electrical, Materials: Corrosion</li> <li>Unit – 2 Numb</li> </ol>	perties of materials such a portance of ionic conducto es (COs): e course, the student should knowledge of material che ical reasoning for explaining common and important me rtance of various properties ed content er of lectures = 7 Tit erials. Advanced Material , thermal, magnetic and of metals and ceremics, d er of lectures = 6 Tit	d be able to: emistry. ing the prince naterials. es of differen le of the uni s, Future ma l optical pro egradation of le of the uni	iples f t types t: Intr terials opertie f polyr t: Poly	for the a s of mat roduction and more es. Cor mers. ymers	atomic-level atomic-level aerials.	ectrical pro l build-up rials rials. Prop l Degrada	of soli
<ul> <li>3. To learn the pro</li> <li>4. To learn the imp</li> <li>10. Course Outcom</li> <li>On completion of the</li> <li>1. Demonstrate the</li> <li>2. Apply the analyt materials.</li> <li>3. Identify the most</li> <li>4. Explain the impo</li> <li>11. Unit wise detailed</li> <li>Unit-1 Numb</li> <li>Classification of materials: electrical,</li> <li>Materials: Corrosion</li> <li>Unit - 2 Numb</li> <li>Polymer melts: The dynamics-Rouse and</li> </ul>	perties of materials such a portance of ionic conducto es (COs): e course, the student should knowledge of material che ical reasoning for explaining common and important metance of various properties ed content er of lectures = 7 Tit erials. Advanced Material , thermal, magnetic and of metals and ceremics, d er of lectures = 6 Tit tube model, viscoelastic Zinn models, polymer ble	d be able to: emistry. ing the prince haterials. es of differen define unit s, Future ma l optical pro- egradation of de of the unit behaviour, cends, copolyn	iples f t types t: Intr terials opertie f polyr t: Poly experimers, i	Tor the a s of mat oduction and modes. Cor mers. ymers mental ncompa	atomic-level atomic-level aerials. <b>on of Mate</b> odern mater rosion and observation atibility and	ectrical pro l build-up rials rials. Prop l Degrada	of sol
3. To learn the pro4. To learn the imp10. Course OutcomOn completion of the1. Demonstrate the2. Apply the analyt materials.3. Identify the most4. Explain the impo11. Unit wise detailedUnit-1NumbClassification of mat materials: electrical Materials: CorrosionUnit - 2NumbPolymer melts: The dynamics-Rouse and Unit - 3Unit - 3Numb	perties of materials such a portance of ionic conductocontance of ionic conductoes (COs):e course, the student should knowledge of material che ical reasoning for explaining common and important mertance of various propertiescommon and important mertance of various propertiesed contenter of lectures = 7Titter of lectures = 7Titter of lectures = 6Titttube model, viscoelasticZinn models, polymer bleer of lectures = 6Titttube model, viscoelasticZinn models, polymer ble	d be able to: emistry. ing the prince haterials. es of differen le of the unit s, Future ma l optical pro- egradation of le of the unit behaviour, ce ends, copolyn le of the unit	iples f t types t: Intr terials opertie f polyr t: Poly experim ners, in t: Ioni	Tor the a s of mate coduction and modes. Cor mers. ymers mental ncompa ic cond	atomic-level atomic-level aerials. <b>on of Mater</b> odern mater rosion and observation atibility and <b>uctors</b>	ectrical pro l build-up rials rials. Prop l Degrada	of sol

superionic conductors, examples and applications of ionic conductors.

Unit - 4Number of lectures = 7Title of the unit: Glasses, Ceramics, and CompositesGlassy state, glass formers and glass modifiers, applications. Ceramic structures, mechanical<br/>properties, clay products. Refractories, characterization, properties and applications.Microscopic composites, dispersion strengthened and particle-reinforced, fibre-reinforced composites,<br/>macrosopic composities.

### 12. Brief Description of self learning / E-learning component

- https://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Material%20Science/pdf/MS\_Syllabus.pdf
- 2. https://nptel.ac.in/courses/112104122/14
- 3. <u>https://www.youtube.com/watch?v=fuMuabkSbYM</u>
- 4. http://textofvideo.nptel.ac.in/118102003/lec15.pdf

- Callisterm, W.D., Jr. Materials Science & Engineering: An Introduction, John Wiley & Sons: New York
- 2. Keer, H.V. Principles of the Solid State, Wiley Eastern Ltd.: New Delhi
- 3. Cowie, J. M.G. Polymers: Chemistry and Physics of Modern Materials, 2nd Ed CRC Press
- 4. Hamley, I. W. Introduction to Soft Matter: Polymers, Colloids, Amphiphiles and Liquid Crystals John Wiley & Sons.
- 5. O. P. Khaanna, Material Science and Matallurgy, Dhanpat Rai publications.

1. Name of	Sector States		1		Unter				
	the De	partment :	Chemis	try					
2. Course N	Name	Advanced	Inorgani	c Spectroscopy		L		Т	Р
3. Course (	Code	17060301				3		0	0
4. Type of	Course	(use tick m	ark)	Core (V)		DS	E ()	SE	EC ()
5. Pre- requisite (if any)	e C H N	B.Sc. ( Chemistry B.Sc.(Non- Medical)	Hons) or	6. Frequency (use tick mark	KS)	Even ()	Odd (🖋	Either Sem ()	Every Sem ()
7. Total Nu	mber o	of Lectures,	Tutoria	ls, Practical (assu	ming	14 we	eks of o	ne semeste	er)
Lectures = 4	0	1		Tutorials = Nil		Pr	actical =	= Nil	
8. Course I	Descrip	tion:							
MÖssbauer determination 9. Course The objective 1. To expla 2. To descr 3. To expla 4. To expla compour 10. Course (	Students Spectron on bas Objecti es of thi in the b ibe the cate the ain the a nds. Dutcom	s will get oscopy and sis of symme ves: s course are: vasic of group principle and principle and principle and principle and principle and principle and principle and principle and principle and principle and	p theory d applica d applica	ation of electron spi ation of Mossbauer ar magnetic resona	in reserved	onance pontance	spectros	s and po scopy r study of	int grou
Jpon succes	sful con	apletion of the	nis cours	e, the student will	be ab	e to			
<ol> <li>Demonstation</li> <li>express to Mossbau</li> <li>Apply the in structs</li> <li>Explain</li> </ol>	trate the the know ter spec te analy tre dete	knowledge wledge of the troscopy, NM tical reasoni rmination of	of grou e princip MR ng for e	p theory. le and application	of ele	ctron s	pin reso	nance spec	ctroscopy
compour	nds.	lication of	inorgan nuclear	ic compounds magnetic resonance	ce sp	ectrosc	ossbaue opy for	r spectroso study of	copy, ESI inorgani
compour 11. Unit wise	nds. e <b>detail</b> e	lication of a	nuclear	ic compounds magnetic resonanc	cation	ectrosc	ossbaue	r spectroso study of	copy, ESI inorgani
compour 11. Unit wise Unit-1	nds. e detaile	ed content Number	of	Title of the Unit:	cation ce spe Grou	p theo	ossbaue opy for ry	study of	copy, ES

# Semester-III

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Principles of ESR, Presentation of the spectrum, hyperfine coupling, hyperfine splitting in various structures, Factors affecting magnitude of g, zero field splitting and Kramer's degeneracy, Applications to transition metal complexes having one and more than one unpaired electron, applications to inorganic free radicals.

Unit – 3	Number of lectures = 10	Title of the Unit: MOssbauer Spectroscopy
MÖssbauer Spec	troscopy: Basic Prin	nciples, spectral display, isomer shift, factors affecting the
technique to the st	mer shift, quadrupol udy of bonding and st	e and magnetic hyperfine interaction, applications of the ructure of $Fe^{2+}$ , $Fe^{3+}$ ; $Sn^{2+}$ and $Sn^{4+}$ compounds.
Unit – 4	Number of	Title of the Unit : Nuclear Magnetic Resonance

lectures = 10 Spectroscopy

**Nuclear Magnetic Resonance Spectroscopy:** <sup>19</sup>F and <sup>31</sup>P NMR spectra – Chemical shifts, coupling constants, <sup>19</sup>F Spectra of fluoroacetone, 1-bromo-1-Fluoroethane, dimethyl phosphorus trifluoride and bromine pentafluoride ;<sup>31</sup>P spectra of HPF<sub>2</sub> HPO(OH)<sub>2</sub> H<sub>2</sub> PO(OH), cis- Pt(Pet<sub>3</sub>)<sub>2</sub> Cl<sub>2</sub>, Application of <sup>31</sup>P NMR for structural determination of Complexes with phosphorus ligands. Introduction of Spectra of Paramagnetic materials

### 12. Brief Description of self- learning / E-learning component

https://www.slideshare.net/christophsontag/spectroscopic-methods-in-inorganic-chemistry-part1-uv-vis

https://www.slideshare.net/christophsontag/nmr-for-inorganic-chemistry

- 1. Inorganic Spectroscopic Methods by Alan K. Brisdon, ISBN: 9780198559498
- 2. Spectroscopy in Inorganic Chemistry by C.N.R. Rao, ISBN: 9780125802024
- 3. NMR, NQR, EPR and Mössbauer spectroscopy in Inorganic Chemistry by R.V. Parish, ISBN 0-13-625518-3
- 4. NMR Spectroscopy in Inorganic chemistry by Jonathan A. Iggo, ISBN-13: 978-0198558903;
- 5. Structural Methods in Inorganic Chemistry by E.A.O. Ebsworth, ISBN-13: 978-0849377327
- 6. Physical Methods in Chemistry by R.S. Drago, ISBN-13: 978-0721631844;
- Introduction to Magnetic Resonance by A. Carrington & A.D. McLachlan, ISBN-13: 978-0063561076;
- Magnetism and Transition Metal Complexes by F.E. Mabbs & D.J. Machin, ISBN- 978-1-5041-2035-7

2. Course Na	ame	Coordination Chem	nistrv	L		Т		Р
3. Course Co	de	17060302	nou y	3		0		0
4.Type of Con	urse (1	use tick mark)	Core	()	DSE (	)	SEC ()	
5. Pre- requisite (if any)	B. Cl (N M	Sc. (Hons) hemistry or B.Sc. Ion	6. (use t	Frequency ick marks)	Even ()	Odd (🖌	Either Sem ()	Every Sem ()
7. Total Nun	nber o	of Lectures. Tutoria	ls. Prac	ticals				
Lectures = 40			Tutor	ials = Nil	P	ractical	= Nil	
8. Course De	escript	tion:				ractical	111	
This core pape metal complex inception and time.	er will tes. T will h	enable postgraduate he course will trace ighlight to students	student all theo how un	s to understand ries of bondin derstanding of	d and ra g in coo f bondir	tionalize ordination ng in con	e bonding i on complex mplexes ev	n transitiones since in volved wi
9. Course Ol	jectiv	ves:						
<ol> <li>To introdu complexes</li> <li>To demon</li> <li>To explai Spectroche</li> <li>To explain</li> <li>To explain</li> <li>To explain</li> <li>Course Out</li> <li>Jpon successful</li> <li>Demonstrat</li> <li>Apply the a</li> <li>Demonstrat</li> </ol>	strate l strate l strate l strate l n imp emical basic n struc nd tran gen co it come al come al come te the l bondi malyti in alyti	the and nephelauxetic sectors of the and nephelauxetic sectors of magnetic ture and bonding in transition metal-pi commolexes) es (COs): appletion of this course knowledge of coordining in transition metal for explicit reasoning for explicit reasoning for Interfundamentals of magnetic fundamentals of magnetic ture and the sector of the	ates are the elec- eries, ch tochemin n metal plexes e, the str nation c al compl plaining erpreting	derived from derived from ctronic spectra harge transfer s istry and apply clusters (bora (metal carbony udent will be a hemistry lexes spectroscopic gthe Orgel and emistry in stru	spectros a of co spectra them in anes, ca yls, pho ible to: c states t d Tanab	nd bond scopic te omplexes n structu urboranes sphines, from spe e-Sugan etermina	ing in trans erms s- Jahn-Te re determin s and meta nitrosyls, ectroscopic to diagrams tion.	sition met Ilar effect nation al carbon; dinitroge
II. Unit wise of	letaile	ed content	<b>T</b> '41	C				
Crystal field t tetrahedral or s and application Unit – 2	heory quare Numbe	- applications and planar complexes, $\pi$ -	Title o Title o Metal	g and molecul of the unit: Complexes	eral-Lig olecula ar orbit Electro	and Bon r orbitat al theory onic Spo	theory, of the o	octahedra ield theor <b>Fransitio</b>
spectroscopic g	ground	l states, correlation a	nd spin-	-orbit coupling	g in free	ions for	r I series of	f transitio
netals, Orgel	and	Tanabe-Sugano diag	grams f	or transition	metal	complex	$d^l = (d^l - d^l)$	$d^9$ states
vidence from	Jq, Ba	and $\beta$ parameters, eff	tect of c	distortion on th	ne d-ort	ital ener	gy levels.	Structura
harge transfor	electro	onic spectrum, Jahn	-Tellar	effect, Spectr	ochemie	cal and	nephelauxe	etic series
Jnit – 3 N	lumbe	er of lectures = $10$	Title o	f the unit: N	compou <b>/agnet</b> i	inds.	erties of 7	ransitio
lementary th	00	of magnetesteri	Metal	Complexes		1		
Asham.	eory	01 magnetochemist	<u>iry, Go</u>	Duy's method	l for	determir	nation of	magnetio

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susceptibility, calculation of magnetic moments, magnetic properties of free ions, orbital contribution, effect of ligand-field, application of magnetochemistry in structure determination, magnetic exchange coupling and spin state crossover.

### Unit – 4 Number of lectures = 10 Title of the unit: Metal- Pi Complexes

Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structure elucidation, important reactions of metal carbonyls; preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand.

### 12. Brief Description of self -learning / E-learning component

- 1. http://nptel.ac.in/courses/104105033/
- 2. https://www.youtube.com/watch?v=g01r2YRH9ok
- 3. http://nptel.ac.in/courses/104106064/lectures.pdf.

- 1. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan, ISBN: 9788121906005,
- 2. Concepts in Inorganic Chemistry, Vol. 3-7, Asim Das and Mahua Das, ISBN 13: 9788123918662
- 3. Advanced Inorganic Chemistry by Cotton and Wilkinson, ISBN: 978-0-471-19957-1
- 4. Advances in inorganic Chemistry by SK Agarwal and Keemti Lal, ISBN-13: 5551234096239
- 5. Inorganic Chemistry- Principles of Structure and Reactivity by James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Okhil K. Medhi, ISBN-13: 978-0060429959

2 0	i the De		ent of Chemist	ry				
2. Course	e Name	Organometallic Che	mistry	]	Ĺ	T		Р
3. Course	Code	17060303		:	3	0		0
4. Type of	Course	(use tick mark)	Core (	5	DS	EO	SF	CO
5. Pre- requisit (if any)	e C (1) M	.Sc. (Hons) hemistry or B.Sc. Non ledical/Medical)	6. Frequenc (use marks)	y tick	Even ()	Odd (🖌	Either Sem ()	Every Sem (
7. Total N	umber o	f Lectures, Tutorials	, Practicals			1.1		
Lectures =	40		Tutorials = N	il	Pr	actical	= Nil	
8. Course l	Descripti	on:						
This course synthesis pr	provide provide	s detailed knowledg and applications in dif	e about organc ferent fields.	ometallio	c comp	ounds,	their class	sificatio
9. Course	Objecti	ves:						
<ol> <li>To enable</li> <li>To class</li> <li>To Explanation</li> <li>To Explanation</li> </ol>	le the stu ify comp ain synth ain kineti	dents to get an idea ab ounds on the basis of esis and reaction meet cs and stability of org	bout organometa bonding. hanisms of orga ganometallic cor	allic con nometa npound	npounds Ilic com	s and the	eir chemis	try.
10. Course	Outcom	es (COs):						
Apply the different a Explain the	e analytic applicatione kinetic	cal reasoning for expons like polymerizations and stability of orga	laining the pro n, catalytic hyd nometallic com	perties rogenati pounds	of orga on etc	nometal	llic compo	ounds fo
II. Unit Wis	e detaile							
Unit-1	Num	d content						
	10	d content ber of lectures =	Title of the	unit: ]	Introdu	ction o	of organo	ometalli
General intr carbonyls, ni arene compo <b>Alkyls and</b> pathways, or	oduction itrosyls, t unds. Me Aryls of ganocop	d content ber of lectures = , Structure and bon ertiary phosphines, hy etal-carbon multiple b Transition Metals: ber in organic synthes	Title of the compounds ding, $\pi$ bonder, onds Types, routes is.	unit: 1 d orga alkyne, of synth	Introdu nometal cyclob nesis, st	ction of lic con utadiend ability a	of organo npounds i e, cyclope and decon	ometalli includin ntadiene npositio
General intr carbonyls, ni arene compo <b>Alkyls and</b> pathways, or Unit – 2	oduction itrosyls, f unds. Me Aryls of ganocop	d content ber of lectures = , Structure and bon ertiary phosphines, hy etal-carbon multiple b Transition Metals: ber in organic synthes er of lectures = 10	Title of the compounds ding, $\pi$ bonder	unit: 1 d organ alkyne, of synth it: Tran	Introdu nometal cyclob nesis, st	ction of lic con utadieno ability a	of organo npounds i e, cyclope and decon	ometalli includin ntadiene npositio
General intr carbonyls, ni arene compo Alkyls and pathways, or Unit – 2 Transition dienyl(metal features, imporganic synth	roduction itrosyls, t unds. Ma Aryls of ganocop Numbe metal a locene) portant r nesis	d content ber of lectures = , Structure and bon ertiary phosphines, hy etal-carbon multiple b Transition Metals: ber in organic synthes er of lectures = 10 t-complexes with complexes, preparati eactions related to n	Title of the compounds ding, $\pi$ bonder ydrides, alkene, onds Types, routes is. Title of the un unsaturated m on, properties ucleophilic and	unit: 1 d orga alkyne, of synth it: Trar olecules and na l electro	Introdu nometal cyclob nesis, st nsition M s- alke ature of ophilic	ction of lic con utadiend ability a <b>Metal</b> $\pi$ enes, a f bondi attack of	of organo npounds it e, cyclopes and decon -Comples lkynes, a ng and s on ligands	ometalli includin ntadiena npositio <b>xes</b> allyl, <i>a</i> structura s and t
General intr carbonyls, ni arene compo Alkyls and pathways, or Unit – 2 Transition dienyl(metal features, imporganic synth Unit – 3	roduction itrosyls, t unds. Me Aryls of ganocop Numbe metal locene) portant r nesis Numbe	d content ber of lectures = , Structure and bom ertiary phosphines, hy etal-carbon multiple b Transition Metals: ber in organic synthes er of lectures = 10 t-complexes with complexes, preparati eactions related to n	Title of the compounds ding, $\pi$ bonder ydrides, alkene, onds Types, routes is. Title of the un unsaturated mon, properties ucleophilic and Title of the un Carbon Multin	unit: 1 d orgat alkyne, of synth it: Trar olecules and na l electro nit: Co ole Bon	Introdu nometal cyclob nesis, st nsition M s- alke ature of ophilic ophilic	ction of $r$ lic condition of the condi	of organo npounds it e, cyclopes and decon -Complex lkynes, a ng and s on ligands	ometalli includin ntadiene npositio <b>xes</b> allyl, <i>d</i> structura s and t
General intr carbonyls, ni arene compo Alkyls and pathways, or Unit – 2 Transition dienyl(metal features, imporganic synth Unit – 3 Fransition m synthesis, rea eactions and	roduction itrosyls, t unds. Me Aryls of ganocop Numbe metal a locene) portant r nesis Numbe	d content ber of lectures = , Structure and bon ertiary phosphines, hy etal-carbon multiple b Transition Metals: ber in organic synthes er of lectures = 10 t-complexes with complexes, preparati eactions related to n er of lectures = 10 bene complexes: Fis ad structures & bondi al features.	Title of the compounds ding, $\pi$ bonder ydrides, alkene, onds Types, routes is. Title of the un unsaturated mon, properties ucleophilic and Title of the un Carbon Multip scher type and ng; Transition r	unit: 1 d orgat alkyne, of synth it: Tran olecules and na l electro nit: Co ole Bon Schroch metal-ca	Introdu nometal cyclob nesis, st nsition M s- alke ature of ophilic ophilic mpoun ds k type rbyne c	ction of lic con utadiend ability a <b>Metal</b> $\pi$ enes, a f bondi attack of <b>ds of</b> T carbene omplex	of organo npounds it e, cyclope: and decon -Complex lkynes, a ng and s on ligands <b>Fransition</b> complex es: their s	ometalli includin ntadiene npositio <b>xes</b> allyl, & structura s and to <b>Metal</b> es, thei ynthesis

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Unit – 4	Number of lectures = 10	Title	of	the	unit:Fluxional	Organometallic
		Comp	ounds	and	role of organometa	illics as catalysts

Fluxionality & dynamic equilibria in compounds such as acyclic alkenes, $\sigma$ -bonded and  $\pi$ -bonded cyclic alkenes, rotation of ligands on metals, ligand scrambling on metals.

Applications of Transition metal Organometallics as Catalysts: Zeigler-Natta polymerization; homogeneous catalytic hydrogenation; alkene hydrogenation-Wilkinson Catalyst; Oxidation of olefins-Wacker's process; hydroformylation of olefins – the oxo process.

# 12. Brief Description of self learning / E-learning component

1. https://onlinecourses.nptel.ac.in/noc18\_cy09/preview.

2. https://ocw.mit.edu/courses/chemistry/5-44-organometallic-chemistry-fall-2004/

- 1. Organometallic Compounds by M.L.H. Green
- 2. Principles of Organometallic Chemistry by G.E. Coates, M.L.H. Green and P. Power.
- 3. Organometallic Chemistry by R.C. Mehrotra
- Basic Organometallic Chemistry: Concepts, Syntheses and Applications by Anil J. Elias and B.D. Gupta
- 5. Chhatwal, G.R and Anand, S.K (2000): Instrumental Methods of Chemical Analysis, Himalaya Publishing House, Delhi, ISBN-13: 978-0906654897

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1. Ivanie of the	Department: Chemist	Durati 1 T	-				
2. Course Name	e Inorganic Special	Practical-I	L		Т		Р
3. Course Code	17060303		0		0		6
4. Type of Cour	se (use tick mark)	Core (		DSF	0	SF	CO
		Core (i	,	DOL	0	SE	C U
5. Pre-requisite (if any)	B.Sc. (Hons) Chemistry or B.Sc. (Non Medical/Medical)	6. Freque (use marks)	ncy tick	Even ()	Odd (🖋	Either Sem ()	Ever Sem O
7. Total Numbe	r of Lectures, Tutorial	s, Practical				247	
Lectures = Nil		Tutorials =	Nil	Practi	cal = 78		
3. Course Descr This module of e	<b>iption:</b> xperiments designed he	re for studen	ts to unde	erstand the	e basic sy	unthesis pr	rinciple
and learn the expe	erimental part of comple	x preparation	with trans	sition elen	nents.		
. Course Obje	ctives:						
The objectives of	this course are:				- 6 -	10.01	
<ol> <li>Demonstrate th</li> <li>Identify the var</li> <li>Apply the ana similar completion</li> </ol>	e knowledge of differen ious colours associated lytical reasoning for co xes changing the metal	t methods of with the partic omparing the	synthesis cular com propertie	of coordir plexes. es of these	nation cor	nplexes. exes by pr	eparin
4. Perform the sy	thesis of inorganic com	pounds which	leads to	a safe labo	oratory er	nvironmen	t.
1. List of Experi	ments						
Preparation of se compounds:	lected Inorganic Compo	ounds comple	exes. Han	dling of	air and n	noisture s	ensitiv
<ol> <li>Chromous</li> <li>Hg [Co(SC</li> <li>[Cu(NH<sub>3</sub>)4</li> <li>[Mn(NH<sub>3</sub>)6</li> <li>K<sub>3</sub> [Fe(C<sub>2</sub>C</li> </ol>	Acetate CN)4 ] (H <sub>2</sub> O) <sub>2</sub> ] SO <sub>4</sub> 5 ] Cl <sub>2</sub> D <sub>4</sub> ) <sub>3</sub> ]						
<ol> <li>VO (acac):</li> <li>Microcosm</li> <li>[Ni(en)<sub>3</sub>]S:</li> <li>Prussian bl</li> <li>[Co(NHc)-</li> </ol>	nic salt 203 ue						
11. K <sub>3</sub> [Al (C <sub>2</sub> (	D4)3] heses of	JU12 , LO(NH	3 <i>)</i> 50N0](	12			

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Abs 10

- i. Bis (acetylacetonato) Copper(II)
- ii. Tris (acetylacetonato) Iron (III)
- iii. Tris (acetylacetonato) Manganese (III)

- 1. Siddiqui, I.R., Singh, J., Shrivastava, J., Yadav, L.D.S., Singh, R.K.P., Singh, J. (2018): Advanced Practical Chemistry, 8<sup>th</sup> Edition, Pragati Prakashan. **ISBN** : 9789386633996
- 2. Agarwal, S.K., Lal, K. Advanced Inorganic Analysis, Pragati Prakashan, ISBN: 9789386306289
- Mendham, J. (2009): Vogel's Textbook of Quantitative Inorganic Analysis, Pearson Education, ISBN-13: 978-8131723258
- 4. Svehla, G., Sivasankar, B. (2012); Vogel's Qualitative Inorganic Analysis, Pearson Education, ISBN-13: 978-8131773710

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	e	Inorga	nic Special Practical - II	L		Т	Р
3. Course Code		17060	304	0		0	6
4. Type of Cou mark)	rse (use	tick	Core (V)		DSE ()	į.	SEC ()
5. Pre requisite (if any)	B.Sc. Chem B.Sc. Medic ical)	(Hons) iistry or (Non cal/Med	6. Frequency (use tick marks)	Even ()	Odd (🖋	Either Sem ()	Every Sem (
7. Total Number	of Lec	tures, T	utorials, Practicals				
Lectures = Nil	T	utorials	$\mathbf{s} = \mathbf{Nil}$		Practic	al = 78	
8. Course Descri	ption:						
<ul> <li>P. Course Object</li> <li>The objectives of</li> <li>1. To learn spect</li> <li>2. To learn spect</li> <li>3. To study of c</li> <li>4. To second</li> </ul>	tives: this cou trophoto omplexa	ometric of ometric of ation (sto	determination of selected determination of pK valu bichiometry and stability	l cations and the of an indi constant) b	d anions cator by Job's met	hod &Slo	pe ratio method
4. To separate a	na aeter	mine dil	ferent salts by complexe	ometric titra	tion		
10. Course Outc		ion of th	is source the student will	ll ha ahla ta	:		
10. Course Outc	complet		is course, the student will	if be able to			
<ol> <li>Course Outc</li> <li>Upon successful of</li> <li>Determine co</li> <li>Determine pk</li> <li>Apply the ana method &amp;Slo</li> <li>Perform the</li> </ol>	ncentrat value o alytical i pe ratio compl	tions of s of an ind reasonin method exometr	selected cations and anio licator spectrophotometri g to determine stoichiom	ns spectrop ically hetry and standard	hotometrica ability const	lly ants of cor salts in	nplexes by Job safe laborator
<ol> <li>Course Outc</li> <li>Upon successful of</li> <li>Determine co</li> <li>Determine pk</li> <li>Apply the ana method &amp;Slo</li> <li>Perform the environment.</li> </ol>	ncentrat Value of alytical peratio	ions of s of an ind reasonin method exometr	selected cations and anio licator spectrophotometri g to determine stoichiom ic titration for determ	ns spectrop ically hetry and standard	hotometrica ability const	ants of con salts in	nplexes by Job safe laborator
<ol> <li>Course Outc</li> <li>Upon successful of</li> <li>Determine co</li> <li>Determine pk</li> <li>Apply the ana method &amp;Slo</li> <li>Perform the environment.</li> <li>List of Exper</li> </ol>	iments	ions of s of an ind reasonin method exometr	selected cations and anio licator spectrophotometri g to determine stoichiom ic titration for determ	ns spectrop ically hetry and stan	hotometrica ability const	lly ants of cor salts in	nplexes by Job safe laborator

C. Cu-ethylenediamine Complexometric Titration:

- 4. Determination of Calcium, Copper, Barium with Ethylene Diamine Tetraacetic Acid (EDTA) and Back titration
- 5. Titration of mixtures using masking agents

### 12. Brief Description of self learning / E-learning component

- 1. https://www.youtube.com/watch?v=98KYUaLe16U.
- 2. http://www.powershow.com/view1/f4f25-

ZDc1Z/Spectrophotometric\_determination\_of\_a\_single\_pKa\_value\_powerpoint\_ppt\_presentation 3. https://www.youtube.com/watch?v=Wn6PS-oTSyM.

- 1. Chatwal,G.R and Anand, S.K (2000): Instrumental Methods of Chemical Analysis, Himalaya Publishing House, Delhi, ISBN-13: 978-0906654897
- Kamalesh Bansal, (2009): Analytical Spectroscopy, Campus Book International, ISBN-13: 978-8187815099
- 3. Spectrometry and Spectrofluorimetry: A Practical Approach by Michael G. Gore, ISBN: 0199638128,

ton

1.	Name of the	Department:	Chen	nistry				
2.	<b>Course Nam</b>	e	Inorg	ganic Special Practic	L	Т	Р	
3.	<b>Course Code</b> 17060305				0	0	6	
4.	Type of Cou mark)	rse (use tick		Core (🖍	DSI	ΞO	SH	EC ()
5.	Pre- requisite (if any)	B.Sc. (Hon Chemistry B.Sc. (No Medical/Med cal)	s) or on li	6. Frequency (use tick marks)	Even ()	Odd ()	Either Sem ()	Every Sem ()
7.	<b>Total Numb</b>	er of Lectures	. Tute	orials. Practicals				

Lectures = Nil	Tutorials = Nil	Practical = 78	
8 Course Description			

### 8. Course Description:

The emphasis of the lab work is on instrumental analysis. In this lab course students will be able to analyse different inorganic compounds by study of FTIR and IR spectra along with identifying fundamental and overtone peaks of compounds.

### 9. Course Objectives:

The objectives of this course are:

- 1. To identify the Infrared spectra of inorganic compounds
- 2. To learn to compare IR spectra of compound synthesized with the theoretical data
- 3. To identify the different bonding of of ligands in inorganic compounds by IR study
- 4. To check the denticity of ligands

### 10. Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

- 1. Demonstrate the knowledge of Infrared spectroscopy
- 2. Apply the analytical reasoning to determine the peaks of compounds in IR spectra
- 3. Identify the fundamental peaks of inorganic salts
- 4. Identify and compare the IR peaks of inorganic ligands with theoretical data

### 11. List of Experiments

Interpretation of IR spectrum and determination of structure/bonding in some simple inorganic compounds and coordination compounds, such as:

- a. Ammonium salts [NH<sub>4</sub>Cl, (NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub>, NH<sub>4</sub> SCN, NH<sub>4</sub> NO<sub>3</sub>]
- b. Sulphate ions in different bonding mode:  $ionic K_2SO_4$ , CaSO<sub>4</sub> etc., unidentate, bidentate, bridged etc.
- c. Thiocynate and Isothiocynate complexes.
- d. Oxalato complexes
- e. Cyano complexes K4Fe(CN)6, Na2 [Fe(CN)5 NO]
- f. Ammine complexes
- g. Spectra of isomers Nitro and Nitrito.

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

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- 1. https://www.youtube.com/watch?v=3olOk\_xNq8g
- 2. https://www.youtube.com/watch?v=3olOk\_xNq8g
- 3. https://www.slideshare.net/nareshbabu7792/thermal-analysis-tga-dta
- 4. https://www.chemie-biologie.uni-siegen.de/ac/be/lehre/.../summary\_of\_tg\_and\_dta.pd
- 5. https://www.perkinelmer.com/CMSResources/.../44-74556GDE\_TGABeginnersGuide

# 13. Books Recommended

1. Chhatwal, G.R and Anand, S.K (2000): Instrumental Methods of Chemical Analysis, Himalaya Publishing House, Delhi, ISBN-13: 978-0906654897

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# Semester III Specialization: Physical Chemistry

1. Name of the Department	: Chemistry		5			
2. Course Name	Chemical Dynam Chemistry	ics & Surface		L	Т	Р
3. Course Code	17060307			3	0	0
4. Type of Course (use tick mark)		Core (🖍	DSE ()		SEC ()	3 e.A.
5. Pre-	B.Sc. (Hons)	6. Frequency	Even	Odd	Either	Every
requisite	Chemistry or		0	(	Sem	Sem ()
(if any)	B.Sc. (Non	(use tick		(•)	0	~
	Medical/Medical)	marks)				
7. Total Number of Lecture	s, Tutorials, Practic	als		10		
Lectures = 52		Tutorials = Nil		Prace	tical = N	ïl
8. Course Description:						
This course will enable the	post graduate stud	ents to understa	ind and	ration	alize th	e basics
thermodynamics of electrified	l interfaces, includin	g Helmholtz-Per	rin, Gouy	-Chap	oman me	odel and
Stern model of electrified inter	rfaces Students will a	lso focuses on th	e interesti	ng co	ncepts of	f surface
chemistry and ionic liquids.				Ned pro		
9. Course Objectives:					6.2	
The objectives of this course a	re:					
1. To provide a firm foundation	tion in electrochemi	stry, chemical d	ynamics :	surfac	e chemi	stry and
ionic liquids.						
2. To introduce the concept o	f thermodynamics of	electrified interfa	ces and c	hemic	al dynar	nics.
3. To describe process of a	dsorption which foc	uses on surface	tension a	nd G	ibb's ad	sorption
equation?						
4. To introduce the importance	e of ionic liquids and	electrodics				
10. Course Outcomes (COs):						
Upon successful completion of	f this course, the stude	ents will be able t	0:			
1. Apply the concept of therm	odynamics on electri	fied interfaces				
2. Describe the simple ionic l	iquids & lattice orien	ted models				
3. Explain the surface chemis	try which includes th	e Gibb's adsorpti	on equati	on and	d its appl	lications
4. Identify and solve the prob	lem related to calcula	tion of energy of	activation	n		
11. Unit wise detailed conten	t					
Unit-1	Number of lecture	s = 10 Tit	e of th	e Ur	nit. FL	ectrified
	rumber of feeture.	Inter Inter	erfaces		nt. En	cumeu
Thermodynamics of electri	fied interfaces: e	ectrocapillary	hermody	namic	s fund	amental
thermodynamic equation of p	olarizable interfaces	determination of	f excess	charo	e density	on the
electrode, electrical capacitan	ce and surface exc	ess of the interf	ace note	ential	of zero	charge
Helmholtz-Perrin model. Goux	- Chapman model a	nd Stern model of	electrifie	d inte	or zero	charge,
Unit – 2	Number of lecture	s = 10 Tit	e of th	e II	nit. C	hemical
		Dvr	amics		int. C	nemical
Methods of determining rate la	ws, collision theory	of reaction rates	steric fac	tor a	tivated (	complex
theory, Arrhenius equation and	the activated comp	ex theory ionic	reactions	Stea	ly state	kinetics
kinetic and thermodynamic co	trol of reactions tree	tment of unimal	cular rea	ctions	Dynam	ic chain
(hydrogen-bromine reaction in	vrolvsis of acetaldeh	vde decomposit	ion of eth	ene)	general	features
(in a observer of on the reaction, p	A A	yae, accomposit		ienc),	general	reatures

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of fast reactions, study of fast	reactions by flow method	d. relaxation method	
Unit – 3	Number of lectures	= Title of the Unit: Adsorption	
	10		
Surface active agents and the	eir classification, concer	pt of micelles, critical micelle concent	tration
(cmc), determination of cmc	by conductivity and sur	rface tension methods: factors affecting	cmc
counter - ion binding to micell	es, thermodynamics of n	nicellization. Surface tension, capillary a	iction
pressure difference across cur	rved surface (Laplace e	equation), Gibb's adsorption equation a	nd it
applications, BET equation and	d its application for the d	determination of surface area;	
Unit – 4	Number of lectures	= Title of the Unit: Ionic Liqui	ds &
	10	Electrodics	
Ionic Liquids: The thermal di	ismantling of an ionic la	ttice, the fundamental problems in the stu	udy of
pure liquid electrolytes, model	ls of simple ionic liquids	s: lattice oriented models (the vacancy n	nodel
the hole model), quantification	n of the hole model, the l	Furth approach to the work of hole form	ation
distribution function for the siz	zes of the holes and the a	average size of a hole.	
Electrodics: Rate of charge- t	transfer reactions under	zero fields, under the influence of an el	lectric
field, the equilibrium exchange	ge current density, the r	non-equilibrium drift-current density (E	Butler-
Volmer) equation. Some gene	eral and special cases o	of Butler-Volmer equation, the high-fiel	d and
low-field approximations, phy	ysical meaning of the	symmetry factor, a simple picture of	of the
symmetry factor and its depend	dence on overpotential.	Polarizable and non-polarizable interfac	es
10 D I 0D I I I 0 100			5.
12. Brief Description of self-le	earning / E-learning co	omponent	
1. http://epgp.inflibnet.ac.in/			
2. http://nptel.ac.in/courses/12	22101001/27		
5. http://www.engr.uconn.edu	V~jmfent/CHEG320_ele	cctrode%20kinetics%20lectures.pdf	
4. <i>https://chem.itbretexis.org</i> .	29: Chemical Kinetics I	II: Reaction Mechanism	
13. Books Recommended			
1. Bockris, J.O.M. and A.K.	N. Reddy. Modern Ele	ectrochemistry Vol.1& 2. ISBN: 978-0	-306-
2 Laidler K L Chemical Kin	ation ISDN: 0700000420	8422	
3 Frost A and G Pearson V	instice and Mashanian	8023	
4 Laidler KI HEvring	and S. Glasstona, The	or Reaction Rates ISBN: 9/8-0-4/1-035	58-9
9780060438623	and 5. Glassione. The	corres of Reaction Rates Kinetics I	SBN:
5. Glasstone, S. Electrochemi	stry ISBN: 97814465454	461	
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2. Course				-	-		<b>D</b>
N	Advanced Quantum & Stat	tistic		L	T		Р
Name	Thermodynamics Mechanic	S					
3. Course Code	17060308			3	0	~	0
4. Type of Co	ourse (use tick		<b>a</b> ( <b>*</b>	DCE			
mark)		10	Core (V)	DSE	0	SEC	0
5. Pre-	B.Sc. (Hons) Chemistry	6.	Frequency	Even	Odd	Either	Every
requisite	or B.Sc. (Non-Medical)		(use tick	0	(1)	Sem ()	Sem (
(if any)			marks)		(•)		
7. Total Num	ber of Lectures, Tutorials, H	Prac	ticals	5			
Lectures = 40		Tu	torials = Nil		Pract	tical = Nil	
8. Course De	scription:						
This course wi	ll enable the post graduate stu	ıden	ts to understand	and rat	ionalize	e the advar	ncement
quantum chem	istry, includes the Approxin	natic	on method and	Born-O	ppenhe	imer appr	oximatio
Students will a	lso covers the interesting cor	ncep	ts of statistical	thermod	ynamic	s such as	concept
listribution, typ	pes of statistic and various par	titio	on functions.				•
9. Course Ol	bjectives:						
The objectives	of this course are:						
1. To provide	the firm foundation in statist	ical	thermodynamics	5.			
2. To explain	the advancement in quantum	med	chanics	÷.			
3. To introdu	ce the concept of ensembles a	nd p	partition function	1			
4. To learn	Born-Oppenheimer approxi	mati	ion, LCAO-MO	) appro	ximati	on as we	ell as t
approxima	tion and perturbation method.						
10. Course Ou	tcomes (COs):						
2. To calculat	te the entropy of idea; gases				:		
<ol> <li>Explain the</li> <li>Demonstra nuclear dia</li> </ol>	e chemical equilibrium and eq te the concept of extension of tomic molecules	uilit f M(	D theory to othe	n terms o r system	s-home	b-nuclear a	ons nd heter
<ol> <li>Explain the</li> <li>Demonstranuclear dia</li> <li>Unit wise dia</li> </ol>	te chemical equilibrium and equite the concept of extension of extension of extension of the concept of extension of the concept of extension of the concept	f MC	Drium constant in D theory to othe	n terms o r system	s-home	b-nuclear a	ons nd heter
<ol> <li>Explain the</li> <li>Demonstranuclear dia</li> <li>Unit wise d</li> </ol>	e chemical equilibrium and eq ite the concept of extension of itomic molecules letailed content Number of lectures = 10	f MC	Drium constant in D theory to othe <b>Fitle of the unit</b>	n terms or r system	s-homo	hermodyn	ons nd heter
4. Demonstra nuclear dia 1. Unit wise d Unit-1	e chemical equilibrium and eq ite the concept of extension of itomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist	f MC	Title of the unit	n terms or r system : Statis amic pro	tical T	hermodyn	ons nd heter amics I
4. Demonstra nuclear dia <b>1. Unit wise d</b> Unit-1 Statistical Ther listribution, Ty	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo	ribu Itzm	Title of the unit tion, thermodyn	n terms of r system : Statis amic protein & F	tical T babilit	hermodyn birac statist	ons nd heter amics I t probab ics and i
<ol> <li>Explain the 4. Demonstra nuclear dia</li> <li>Unit wise d Unit-1</li> <li>Statistical Ther distribution, Ty tatistical ther</li> </ol>	e chemical equilibrium and eq ite the concept of extension of itomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo modynamic formulation, Idea	f MC	Title of the unit tion, thermodyn mann, Bose-Eins microstates an	r system <b>Statis</b> amic pro- tein & F ad macr	tical T obabiliti ermi-E ostates	hermodyn ty and mos Dirac statist	ons nd heter amics I t probab ics and i cal, grar
4. Demonstra nuclear dia <b>1. Unit wise d</b> <b>Unit-1</b> Statistical Ther distribution, Ty statistical thermicanonical and	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo nodynamic formulation, Idea microcanonical ensembles.	uilit f MC ribu ltzm a of Stat	Title of the unit tion, thermodyn ann, Bose-Eins microstates ar	r system <b>Statis</b> amic pro- tein & F nd macr ynamic	tical T obabilit ermi-D ostates formul	hermodyn b-nuclear a hermodyn ty and mos Dirac statist . Canonie ation of N	ons nd heter amics I t probab ics and i cal, gran Maxwell
4. Demonstra nuclear dia <b>1. Unit wise d</b> <b>Unit-1</b> Statistical Ther distribution, Ty statistical ther canonical and Boltzmann dist	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo modynamic formulation, Ides microcanonical ensembles. ribution law, Maxwell - Bolt	uilit f MC ribu ltzm a of Stat	<b>Fitle of the unit</b> <b>Title of the unit</b> <b>tion, thermodyn</b> <b>nann, Bose-Eins</b> <b>microstates ar</b> <b>istical thermody</b> <b>unn law of distri</b>	r system <b>Statis</b> amic pro- tein & F nd macr ynamic bution o	tical T obabilit cermi-D ostates formul	hermodyn b-nuclear a hermodyn ty and mos Dirac statist . Canonia ation of N gy and eva	ons nd heter amics I at probab ics and i cal, gran Maxwell iluation
4. Demonstra nuclear dia <b>1. Unit wise d</b> <b>Unit-1</b> Statistical Ther distribution, Ty statistical therr canonical and Boltzmann dist	e chemical equilibrium and eq ite the concept of extension of itomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo nodynamic formulation, Ides microcanonical ensembles. ribution law, Maxwell - Bolt y, root mean square velocity;	uilit f MC litzm a of Stat zma law	Title of the unit Title of the unit tion, thermodyn ann, Bose-Eins microstates ar istical thermody ann law of distri of equipartition	r system <b>Statis</b> amic pro- tein & F ad macr ynamic bution of of energ	tical T babilit babilit cermi-D ostates formul of energy; Part	hermodyn bermodyn ty and mos Dirac statist Canonia ation of N gy and eva ition funct	ons nd heter amics I t probab ics and i cal, gran Maxwell iluation ion and i
4. Demonstra nuclear dia <b>1. Unit wise d</b> Unit-1 Statistical Ther distribution, Ty statistical thern canonical and Boltzmann dist werage velocit factorization, r	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo nodynamic formulation, Idea microcanonical ensembles. ribution law, Maxwell - Bolt y, root mean square velocity; elationship of atomic and mo	ribu ltzm Stat zma law olar	Title of the unit Title of the unit tion, thermodyn ann, Bose-Eins microstates an istical thermody of equipartition partition functi	r system r system : Statis amic pro- tein & F ad macr ynamic bution of of energ on to th	tical T obabilit ermi-D ostates formul of energy; Part	hermodyn bermodyn ty and mos Dirac statist . Canonid ation of M gy and eva ition funct ynamic pro	ons nd heter <b>amics I</b> t probab ics and i cal, gran Maxwell iluation ion and i operties(
<ol> <li>Explain the A. Demonstra nuclear dia nuclear dia <b>Unit wise d</b> Unit-1 Statistical Ther distribution, Ty statistical thern canonical and Boltzmann distance average velocit factorization, r nternal energy       </li> </ol>	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo modynamic formulation, Ides microcanonical ensembles. ribution law, Maxwell - Bolt y, root mean square velocity; elationship of atomic and me (ii) entropy (iii) Gibb's free of	ribu f MC ribu ltzm a of Stat zma law olar ener	Title of the unit Title of the unit tion, thermodyn ann, Bose-Eins microstates ar istical thermody ann law of distri of equipartition partition functi gy (iv) heat con	: Statis amic pro- tein & F ad macr ynamic bution of of energ on to th tent (v)	tical T obabilit ostates formul of energy; Part nermod work f	hermodyn b-nuclear a hermodyn ty and mos Dirac statist . Canonia ation of N gy and eva ition funct ynamic pro unction (vi	ons nd heter amics I t probab ics and i cal, gran Maxwell iluation ion and i operties( i) pressu
<ol> <li>Explain the A. Demonstra nuclear dia <b>1. Unit wise d</b> <b>Unit-1</b> Statistical Ther distribution, Ty statistical therr canonical and Boltzmann dist average velocit factorization, r nternal energy (vii) heat capac         </li> </ol>	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo nodynamic formulation, Idea microcanonical ensembles. ribution law, Maxwell - Bolt y, root mean square velocity; elationship of atomic and me (ii) entropy (iii) Gibb's free of ity at constant volume. Deriv	in the second se	Title of the unit Title of the unit tion, thermodyn ann, Bose-Eins microstates an istical thermody ann law of distri of equipartition partition function gy (iv) heat con n of equation of	: Statis amic pro- tein & F ad macr ynamic bution of of energon to th tent (v) state for	tical T babilit babilit cermi-D ostates formul of energy; Part nermod work f c a mon	hermodyn b-nuclear a hermodyn ty and mos Dirac statist Canonic ation of N gy and eva ition funct ynamic pro unction (vi oatomic id	amics I amics I t probab ics and i cal, gran Maxwell iluation ion and i operties( i) pressu leal gas.
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<ol> <li>Explain the A. Demonstra nuclear dia nuclear dia <b>1. Unit wise d</b> Unit-1 Statistical Ther distribution, Ty statistical therr canonical and Boltzmann dist average velocit factorization, re- nternal energy (vii) heat capac Unit – 2 Evaluation of     </li> </ol>	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo nodynamic formulation, Ides microcanonical ensembles. ribution law, Maxwell - Bolt y, root mean square velocity; elationship of atomic and me (ii) entropy (iii) Gibb's free of ity at constant volume. Deriv Number of lectures = 10 Translational partition fun-	uilit f MC f MC ribu ltzm a of Stat zma law olar ener ation 1 ctior	Title of the unit Title of the unit tion, thermodyn ann, Bose-Eins microstates an istical thermody unn law of distri of equipartition partition functi gy (iv) heat con n of equation of Title of the unit n, calculation	r system <b>Statis</b> amic pro- tein & F ad macr ynamic bution of of energ on to th tent (v) state for <b>Statis</b> of abso	tical T bababilit cermi-D ostates formul of energy; Part nermod work f c a mon tical T lute e	hermodyn b-nuclear a hermodyn ty and mos Dirac statist . Canonia ation of N gy and eva ition funct ynamic pro- unction (vr toatomic id hermodyn ntropy of	amics I amics I t probab ics and i cal, gran Maxwell iluation ion and i operties( i) pressu leal gas. amics II an ide
<ol> <li>Explain the A. Demonstra nuclear dia 1. Unit wise d Unit-1 Statistical Ther distribution, Ty statistical thern canonical and Boltzmann dist average velocit factorization, ru nternal energy (vii) heat capac Unit – 2 Evaluation of monoatomic ga 2 Statistical thern and Boltzmann dist autoration, ru nternal energy (vii) heat capac Boltzmann of autoration of nonoatomic ga</li></ol>	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo nodynamic formulation, Idea microcanonical ensembles. ribution law, Maxwell - Bolt y, root mean square velocity; elationship of atomic and me (ii) entropy (iii) Gibb's free of ity at constant volume. Deriv Number of lectures = 10 Translational partition fun- as, Vibrational, Rotational, <i>&amp;</i>	uilit f MC f MC ribu ltzm a of Stat zma law olar ener ation 1 ctior	Title of the unit Title of the unit tion, thermodyn ann, Bose-Eins microstates an istical thermody of equipartition partition functing gy (iv) heat con n of equation of Title of the unit n, calculation ectronic partitio	r system <b>Statis</b> amic pro- tein & F ad macro- ynamic bution of of energion to the tent (v) state for <b>Statis</b> of abso- n function	tical T obabilit fermi-D ostates formul of energy; Part hermod work f ta mon tical T fute e ion of	hermodyn bermodyn ty and mos Dirac statist Canonic ation of M gy and eva ition funct ynamic pro- unction (vi oatomic id hermodyn ntropy of diatomic r	ons nd heter amics I t probab ics and i cal, gran Maxwell iluation ion and i operties( i) pressu leal gas. amics II an ide nolecule
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<ol> <li>Explain the A. Demonstra nuclear dia 1. Unit wise di Unit-1 Statistical Ther distribution, Ty statistical thern canonical and Boltzmann dist average velocit actorization, r nternal energy vii) heat capac Unit – 2 Evaluation of nonoatomic ga Derivation of e snropy, Gibbs nolecule. Cher nergy function         </li> </ol>	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo modynamic formulation, Idea microcanonical ensembles. ribution law, Maxwell - Bolt y, root mean square velocity; elationship of atomic and ma (ii) entropy (iii) Gibb's free of ity at constant volume. Deriv Number of lectures = 10 Translational partition fundas, Vibrational, Rotational, & xpressions for transitional, vi free energy, work function du mical equilibrium and equili	uilit f MC ribu ltzm a of Stat zma law olar ener ation ation 2 ela ibrat ue to ibrat	Title of the unit Title of the unit tion, thermodyn nann, Bose-Eins microstates ar istical thermody unn law of distri of equipartition partition functi gy (iv) heat con n of equation of Title of the unit n, calculation ectronic partitio ional, rotational o transitional, vi im constant in	terms of absorb r system <b>: Statis</b> amic pro- tein & F ad macro ynamic bution of of energo on to the tent (v) state for <b>: Statis</b> of absorb n function , electron brationa	tical T obabilit obabilit ostates formul of energy; Part nermod work f c a mon tical T lute en on of nic energy of parti	hermodyn ty and mos Dirac statist . Canonid ation of N gy and eva ition funct ynamic pra unction (vi ioatomic id hermodyn ntropy of diatomic r ergy; expre- otational m tion funct	ons nd heter amics I t probab ics and i cal, gran Maxwell iluation ion and i operties( i) pressu leal gas. amics II an ide molecule essions for ions, Fro
<ol> <li>Explain the A. Demonstra nuclear dia 1. Unit wise d Unit-1 Statistical Ther distribution, Ty statistical therr canonical and Boltzmann dist verage velocit actorization, r nternal energy vii) heat capac Unit – 2 Evaluation of nonoatomic ga Derivation of e mtropy, Gibbs nolecule. Chere nergy function         </li> </ol>	e chemical equilibrium and eq te the concept of extension of tomic molecules letailed content Number of lectures = 10 modynamics: Concept of dist pes of statistics: Maxwell Bo nodynamic formulation, Ides microcanonical ensembles. ribution law, Maxwell - Bolt y, root mean square velocity; elationship of atomic and me (ii) entropy (iii) Gibb's free of ity at constant volume. Deriv Number of lectures = 10 Translational partition fun- as, Vibrational, Rotational, & xpressions for transitional, vi free energy, work function dur- mical equilibrium and equili	uilit f MC ribu ltzm a of Stat: zma law olar ener ation 2 ctior ctior k eld brat ue tc ibriu	Fitle of the unit Title of the unit tion, thermodyn nann, Bose-Eins microstates ar istical thermody nn law of distri of equipartition partition function gy (iv) heat con n of equation of Fitle of the unit n, calculation ectronic partition ional, rotational o transitional, vi im constant in	<ul> <li>system</li> <li>system</li> <li>system</li> <li>amic protection &amp; Feature</li> <li>amic protection &amp; Feature</li> <li>amic protection &amp; Feature</li> <li>bution &amp; Feature</li> <li>bution &amp; feature</li> <li>of energy</li> <li>on to the terms of absorbing</li> <li>absorbing</li> <li>functional terms of absorbing</li> </ul>	tical T babilit ermi-D ostates formul of energy; Part formul of energy; Part nermod work f a mon tical T blute en ion of nic energy formul of parti	hermodyn ty and mos Dirac statist . Canonia ation of N gy and eva ition funct ynamic pro- unction (vin oatomic id hermodyn ntropy of diatomic r ergy; expre- otational m tion funct	amics I amics I t probab ics and i cal, gran Maxwell duation of ion and i operties( i) pressur leal gas. <b>amics II</b> an ide molecule essions for ions, Free

Johanne.

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Unit - 3	Number of lectures = 10	Title of the unit: Quantum Mechanics- I			
Approximate r	nethods: First order time-independe	ent perturbation theory for non-degenerate states,			
variation princ	ple. Application of first order pertu	urbation and variation principle to evaluate ground			
state of helium	atom. Applicability of perturbatio	n theory to an electron in a one dimensional box			
under the influence of electric field.					
Unit – 4	Number of lectures = 10	Title of the unit: Quantum Mechanics- II			
Born-Oppenhe	imer approximation, Valence bond	method to hydrogen molecule ion and hydrogen			
molecule their	symmetric and anti-symmetric solu	tion without actual evaluation of various integrals,			
energy of mo	olecular hydrogen system, LCAC	O-MO approximation of hydrogen molecule,			
Configuration	Interaction. Extension of MO	theory to other systems- Homonuclear and			
heteronuclear diatomic molecules.					
heteronuclear c	liatomic molecules.				
heteronuclear of 11. Brief Desc	<mark>liatomic molecules</mark> . ription of self-learning / E-learnin	ig component			
heteronuclear of 11. Brief Desc 1. http://epgp.	l <mark>iatomic molecules</mark> . r <mark>iption of self-learning / E-learnin</mark> inflibnet.ac.in/	g component			
heteronuclear of11. Brief Desc1. http://epgp.2. https://yout	liatomic molecules. ription of self-learning / E-learnin inflibnet.ac.in/ u.be/bE7Z6Zkst1I	ng component			
heteronuclear of11. Brief Desc1. http://epgp.2. https://yout3. https://yout	liatomic molecules. ription of self-learning / E-learnin inflibnet.ac.in/ u.be/bE7Z6Zkst1I u.be/CBrsWPCp rs	ig component			
heteronuclear of11. Brief Desc1. http://epgp.2. https://yout3. https://yout4. https://yout	liatomic molecules. ription of self-learning / E-learnin inflibnet.ac.in/ u.be/bE7Z6Zkst1I u.be/CBrsWPCp_rs u.be/7ItAyG m7jA	ng component			
heteronuclear of11. Brief Desc1. http://epgp.2. https://yout3. https://yout4. https://yout5. http://chem	liatomic molecules. ription of self-learning / E-learnin inflibnet.ac.in/ u.be/bE7Z6Zkst1I u.be/CBrsWPCp_rs u.be/7ItAyG_m7jA istry.umeche.maine.edu/Modeling/l	eg component			
heteronuclear of11. Brief Desc1. http://epgp.2. https://yout3. https://yout4. https://yout5. http://chem12. Books Rec	liatomic molecules. ription of self-learning / E-learnin inflibnet.ac.in/ u.be/bE7Z6Zkst1I u.be/CBrsWPCp_rs u.be/7ItAyG_m7jA istry.umeche.maine.edu/Modeling/h ommended	eao.html.			
heteronuclear of11. Brief Desc1. http://epgp.2. https://yout3. https://yout4. https://yout5. http://chem12. Books Rec1. Glasstone,	liatomic molecules. ription of self-learning / E-learnin inflibnet.ac.in/ u.be/bE7Z6Zkst1I u.be/CBrsWPCp_rs u.be/7ItAyG_m7jA istry.umeche.maine.edu/Modeling/li ommended S. Theoretical Chemistry ISBN: 978	eao.html.			

- 3. Pauling, Eyring and Wilson. Quantum Chemistry ISBN: 978-0486648712
- 4. Nash, L.K. Introduction to Statistical Mechanics ISBN: 978-0486449784

Asham.

- 5. Donald. A. McQuarrie Statistical Mechanics-2011 ISBN: 978-8130918938
- 6. Frank L. Pilar, Elementary Quantum Chemistry 2001 ISBN: 9780486414645.

to
2. Course Name	Solid State and Chemistry	d Biophysical		L		Т	Р
3. Course Code	17060309		1	3		0	0
4. Type of Course	(use tick mark)	Core (V)	1	DSI	EO	SI	EC 0
5. Pre- B.S requisite Che (if any) (No	c. (Hons) emistry or B.Sc. on-Medical)	6. Frequency (use tick ma	arks)	Even	Odd O	Either Sem ()	Every Sem ()
7. Total Number of	Lectures, Tutorials	, Practicals					
Lectures = 40		Tutorials =	= Nil	1.1	Pr	actical =	Nil
8. Course Descript	ion:						Sec. Contraction
in solid state chemis The students will also	try. It also covers the be made familiar w	e chemistry of bi ith bio-molecular	opoly simul	ner and ations	macroi	ne concep nolecular	solution
5. Course Objecti	ves:						
<ol> <li>To provide an int</li> <li>To illustrate the v</li> <li>To enable studen</li> <li>To introduce stusimulations</li> </ol>	roduction to the conc wide range of materia ts to identify differen udents to the practi	cepts underlying s ils and physical pr t types of polyme cal application of	olid st roperti ers in c of pol	ate chen es curren our surro ymers a	nistry ntly ava undings und exp	uilable s plain bio-	molecula
10. Course Outcom	es (COs):						
<ol> <li>Demonstrate the standard</li> <li>Demonstrate the standard</li> <li>Understand the b</li> <li>Unit wise det</li> </ol>	solid solutions includ iopolymer interaction tailed content	ling phase transiti	ons. dynam	ics of m	acromo	blecular so	lutions
Unit-1 Nui	mber of lectures $= 1$	0 Title of	the u	nit: Soli	d state	- I	
Solid state reaction Characterization of diffraction and neutr non stoichiometry: po colour centres. extend	ns: experimental p solids: Physical tech on diffraction; micro erfect and imperfect of ded defects; stacking	procedures, facto iniques diffractio oscopic technique crystals, thermody faults, grain bour	ors in on met es; SE ynamio ndaries	fluencin hods; X M and T cs of Scl and dis	g soli (-rays c FEM. C nottky a locatior	d state diffraction Crystals de and Frenk as.	reactions , electro efects an el defects
Unit – 2 Num	ber of lectures = 10	Title of t	he uni	t: Solid	State -	· II	
Solid solutions: Sul formation, experime thermodynamic class mechanism in ionic of semiconductors, n-ty	bstitutional and intentional methods for stuing ifications of phase transformed by the second super- period p-type semicory period by the semicory of the second second by the second by	erstitial solid soludying solid solu ansitions. Conductionic conductors, onductivity	lutions, ations, ctivity band	s, requir Phase in solids theory o	rement transitions: struct of metal	for solid ons, Buer ture and c s, band st	solution ger's and onduction ructure o
Unit – 3 Nur	mber of lectures = 1	0 Title of the	unit: l	Biophysi	ical		
Biopolymer interact interaction, Electros interaction. Multiple Thermodynamics of Osmotic pressure and	tions and Thermod tatic: dipole-dipole Equilibria and var biopolymer solution Donnan membrane	lynamics of Ma interaction, Disp ious types of bi ns, Flory-Huggir equilibrium.	persion nding ns mo	olecular force process del of f	soluti interac ses in nacrom	ons: Nor ction, Hy biological nolecular	n-covaler drophobi systems solvatior
Aspan.	A	ØĴ	p9	h		V.	

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Unit – 4	Number of l	ectures = 10	Title of Biomolecu	the unit: lar simulati	Statistical	Mechanics	and
Statistical N	⊥ Aechanics_and	Biomolecular	simulation	s. Chain c	onfiguration	of macromole	eule
Random wa	lk model and	statistical distri	oution of en	nd to end di	mension. Cal	culation of ave	erage
dimension of	of various chai	n structures. C	onformation	nal transition	ns: Helix-coil	transition. Pr	otein
folding prob	lem. Molecular	mechanics and	dynamics:	Basic princip	oles – molecul	ar representation	ons –
force fields -	- atom-atom pa	air potentials –	oond length	and bond an	ngle and torsic	on angle poten	tial –
van der Waa	ls and electrost	atic potential co	ncepts of m	olecular dyn	amics - intro	duction to time	e-step
integration a	lgorithms and f	force fields.					
12. Brief De	scription of se	lf-learning / E-	learning co	mponent			
1. http://ww	ww.scielo.br/sci	elo.php?script=	sci arttext8	pid=S0103-	50532002000	100004.	
2. https://w	ww.chem.uci.e	du/~lawm/Basic	:%20West%	20Ch%201.	pdf		
3. https://le	seprobe.buch.d	e/images-adb/3	5/0c/360cdf	9a-dc74-482	8-b88e-3d807	e0b79b8.pdf	
4. <u>http://iop</u>	science.iop.org	z/article/10.1088	/0953-8984	/18/14/E01/1	meta		
13. Books R	ecommended						
1. Biophysi	cal Chemistry	Part I, II, III –	Charles R (	Cantor, Paul	R. Schimmel,	W. H. Freema	an of
Company	y ISBN: 978-0	716711889					
2. Biophysi	cal Chemistry	– P.S. Kalsi an	d N. Maha	nta New Age	e Internationa	l Publishers IS	SBN:
3. Textbool	of Biophysic	al Chemistry- I	I N Dash N	Acmillan In	dia Bockris	IOM and A	KN
Reddy, N	Adern Electro	chemistry, Vol.	& 2 ISBN	978-1-4615	-7467-5	5.0.101. and A.	1.1.1.
4. Glasston	e, S. Electroche	emistry ISBN: 9	78-144372	2940	1107 5		
5. Reiger, F	H. Electroche	mistry ISBN : 9	78-94-011-	0691-7			-
6. Heyrovsl	cy. Polarograph	y ISBN: 97814	83227467				
7. Kannala,	Zutshi. Introdu	iction to Polaro	graphy and	Allied Techn	iques ISBN:	978-81224179	13
							10
		A	· ·	/	An h		
Rho	who .	4		Q.		Ν.	
Har		2				4	
N						O	

2. Course Name	Physical Special	Practical -1	L		Т		Р
3. Course Code	17060310		0		0		6
4. Type of Cour	se (use tick mark)	0 ( )		DC		SE	C O
- Dec		Core ()	- 54	DS	E ()	51	
5. Pre- requisite (if any)	B.Sc. (Hons) Chemistry or B.Sc (Non Medical/Medical)	6. Freque (use marks)	ency tick	Even ()	Odd ()	Either Sem ()	Every Sem (
7. Total Number	r of Lectures, Tutoria	ls, Practical					
Lectures = Nil		Tutorials =	= Nil	Pr	actical	= 78	
8. Course Descr	iption:						
concepts of charac polarimeter and d experimentation to	cterizing an acid with ipole metry. It will al quality control metho	out indicators. so give a plat ds of analysis.	Students with the students wit	will also evelop v	learn v arious	various consistent of l	aborator
7. Course Objec							
<ol> <li>To explain the</li> <li>To determine laevo-rotation</li> <li>To predict the</li> <li>To learn the way</li> </ol>	principles of potention the specific rotation of of substances. dielectric constant orking of potentiomete	neter, polarim of optically ac r, polarimeter	eter and dip tive substant	pole met ances ar meter	ter. nd ident	tify the d	extro ar
10. Course Outco	mes (COs):				14		
determination of 2. Describe vario 3. Describe applie 4. Determine the	of <i>Dipole</i> Moment. us potentiometric titrat cation and functioning specific rotation of var	ions. polarimeter. ious optically	active subs	stances.			ia nene
11. List of Experi	ments		a contraction of the second se		1	1.2	1.1
<ol> <li>Potentiometric         <ol> <li>Mohr's salt o</li> <li>Mohr's salt o</li> <li>Mohr's salt o</li> <li>KCl or KI vs</li> <li>(KCl + KI) v</li> <li>(KCl + KBr -</li> <li>Ce<sup>4+</sup> vsFe<sup>2+</sup>ti</li> </ol> </li> <li>Polarimetry</li> </ol>	titrations r FeSO4 vs KMnO4titr r FeSO4vs K2Cr2O7titr s AgNO3titration s AgNO3 mixture titrat KI) vs AgNO3 mixtur tration.	ation ation. tion e titration					
To determine To determine	ne specific rotation for ne concentration of glu ine the percentage co rise of Glucose or Fruc ne the dielectric consta	various optica cose or fructo omposition of ctose or sucros nt of various o	Illy active s se or sucro optical s e or Tarta organic liqu	substanc se or tar ubstance ric acid iids.	es. taric aci es in tl )	id in solut ne binary	ion. mixtur
2. Brief Descript	ion of self-learning / I	E-learning con	nponent				1000
1. https://youtu.be	/g5z6EaT46iA						1.3
III . Dipolemetry         a.       To determine         12. Brief Descript         1.       https://youtu.be	ne the dielectric consta ion of self-learning / I e/g5z6EaT46iA	nt of various c	e or Tarta organic liqu <b>nponent</b>	ric acid	)		

- 2. https://youtu.be/JwCeCS2YRVo
- 3. https://youtu.be/mFE1EBsPEas
- 4. www.iiserpune.ac.in/~bhasbapat/phy221\_files/SITechPolar.pdf
- 5. https://www.jhuapl.edu/techdigest/views/pdfs/V07\_N1\_1967/V7\_N1\_1967\_Tossman.pdf

- 1. Khosla, B.D., V.C. Garg and A. Gulati. Senior Practical Physical Chemistry.
- 2. Thawale, A. and P. Mathur. Experimental Physical Chemistry.
- 3. Vishwanatha, B. and P. S Raghav. Practical Physical Chemistry.
- 4. Sindhu, P.S. Practical in Physical Chemistry.

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2. Course Name	Physical Special pra	ctical-II	L	1	Г	Р
3. Course Code	17060311		0		)	6
1 Trme of Course		1			,	0
+. Type of Cours	e (use tick mark)	Core ()		DSE ()	SI	E <b>C</b> ()
5. Pre-	B.Sc. (Hons)	6. Frequ	ency	Even Od	d Either	Every
requisite	Chemistry or B.Sc.	(use	tick	0 . ()	Sem ()	Sem (
	(Non Medical/Medical)	mark	s)			
7 Total Number	of Lectures Tutorial	Draatiaal				
ectures = Nil	of Lectures, Tutorian	Tutorial	- N8	Ducati		
Course Descri	ntion	Tutoriais		Practic	cal = 78	
This course will e	ption.	tionalize th	a annliastian	C 1		
lame photometer	Students can apply th	nonalize in	behind aci	d base titret	tometer, pH	meter an
strength of unknow	on solutions by measur	ing the mol	bility of ion	u base titrat	ions and cal	n IIna th
will help the stude	its to find out pH of the	solutions a	and make the	m familiar t	o Flame phot	pri mete
, Course Object	tives:		muite uit		e i funic pho	omen y.
The objectives of t	his course are to:					
. To provide the	firm foundation on con	ductometri	titration			
2. To determine t	ie conductivity of citrus	s fruits and	succinic aci	and with di	ifferent acid	and base
3. To demonstrate	the pH of different sol	utions	succine uch		interent dela	and base
4. To perform exp	periments on alkali and	alkali earth	metals by th	ermally diss	ociating in f	lame.
0. Course Outco	mes (COs):			•		
Jpon successful co	mpletion of this course	, the studen	t will be abl	e to		
. Explain the theo	ry behind conductivity	of ions				
2. Describe the app	olication of pH meter					
3. Verify the Deby	e Hückel Onsager equa	tion for stro	ong electroly	tes		
. Demonstrate ap	blication and working o	f flame pho	otometer.			
1. List of Experi	nents					
Citric poid	c titrations					
Succinic A	vid ve NaOH					
CH <sub>2</sub> COOH	vs NH4OH					
HCl vs CH	COONa					
. (HCl + CH	COOH) vs NaOH mixt	ure				
(HCl + CH	COOH + CuSO <sub>4</sub> ) vs Na	aOH mixtu	re.			
g. To study the	ne conductometry titra	tion of hyd	drochloric a	cid with so	dium carbon	ate. Als
determine t	ne concentration of sodi	ium carbona	ate in a com	mercial samp	ole of soda as	sh.
KCl or KI v	s AgNO <sub>3</sub>					
1. To	determine solubility ar	nd solubilit	ty product of	of sparingly	soluble sal	ts (AgC
PDSO4, Bas	O4)	e c				
I nH metric titra	tions	uation for s	trong electro	olytes.		
	titration vs NaOH					
1. Succinic Aci						
<ol> <li>Succinic Acid</li> <li>Citric Acid ti</li> </ol>	tration vs NaOH					
<ol> <li>Succinic Acid</li> <li>Citric Acid ti</li> <li>To predict co</li> </ol>	tration vs NaOH mposition of Copper an	nine comple	ex from CuS	O₄ vs.NH₄O	H titration	
<ol> <li>Succinic Acid</li> <li>Citric Acid ti</li> <li>To predict co</li> <li>To determine</li> </ol>	tration vs NaOH mposition of Copper an dissociation constant of	nine comple f weak acid	ex from CuS	O4 vs.NH4O	H titration.	
<ol> <li>Succinic Acid</li> <li>Citric Acid ti</li> <li>To predict co</li> <li>To determine</li> <li>II. Flame Photom</li> </ol>	tration vs NaOH mposition of Copper an dissociation constant of etry	nine comple f weak acid	ex from CuS	O4 vs.NH4O	H titration.	
<ol> <li>Succinic Acid</li> <li>Citric Acid ti</li> <li>To predict co</li> <li>To determine</li> <li>II. Flame Photom</li> </ol>	tration vs NaOH mposition of Copper an dissociation constant of etry	nine comple f weak acid	ex from CuS	O4 vs.NH4O	H titration.	

1. To determine the concentration of Na+ or Li+ or Ca++ ions in solution.

# 12. Brief Description of self-learning / E-learning component

- 1. https://nptel.ac.in/courses/122101001/37
- 2. https://nptel.ac.in/courses/122101001/Slide/lect38/38\_6.htm
- 3. https://nptel.ac.in/courses/122101001/Slide/lect38/38\_4.htm
- 4. https://youtu.be/JhBs\_8DrPYo
- 5. https://youtu.be/2tJqZStFwjU

- 1. Khosla, B.D., V.C. Garg and A. Gulati. Senior Practical Physical Chemistry.
- 2. Thawale, A. and P. Mathur. Experimental Physical Chemistry.
- 3. Vishwanatha, B. and P. S Raghav. Practical Physical Chemistry.
- 4. Sindhu, P.S. Practical in Physical Chemistry.

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2. Course Nan	ne	Physical Special	Practical-	L		T		Р
		III				-		
3. Course Code		17060312	1	0		0		6
4. Type of Cour	se (us	e tick mark)	Core (	1	D	SE ()	SE	EC ()
5. Pre- requisite (if any)	B.So Che (No: Mec	c. (Hons) mistry or B.Sc. n lical/Medical)	6. Free (use marl	quency tick (s)	Even ()	Odd ()	Either Sem ()	Every Sem ()
7. Total Numbe	r of L	ectures, Tutorials	, Practical	ls				
Lectures = Nil			Tutorial	s = Nil	P	ractical	= 78	
. Course Descr	iptior	1:				6		
This course pro interferometer an knowledge about	vides d spec the kin	practical training tro calorimeter. The tics of different re	y on the his lab cou eactions ar	use of spe arse also enand the factors	cial in bles th it dep	nstrumen e studen ends upo	ts like to ts to have n.	Ultrasonio e practica
. Course Obie	ctives							
<ul> <li>To have clear</li> <li>To explain te clock reaction</li> <li>To learn the address of the clock reaction</li> <li>To enable study</li> </ul>	conce rms li ctivati lents t	pts about kinetics of ke rate law, order on energy for hydro to apply the basic p	of a reactio of reaction olysis of an orinciples of	n. on, molecula n ester of UV-visible	arity and a spect	nd chemi	istry behi neter and	nd iodino determino
concentration	of unl	nown solutions fro	om their $\lambda_{\rm rr}$	ax values.				
10. Course Outco	omes (	(COs):						
<ol> <li>Measure the space of any coloure</li> <li>Determine the</li> <li>Study reaction</li> </ol>	rt-Bee d solu activa kinet	of sound for various or's law by different tion. ation energy for hydrics of the iodine clo	i liquids. at coloured drolysis of ock reactio	solutions ar an ester. n.	nd find	the unkr	nown con	centratior
1. List of Exper	iment	5						
I.Ultrasoniea.To measureb.To determII.Calorimeta.To test theb.To determdichromate in theTo study cII.Chemical	e Inter e speci ine the ry validi ine the given omple Kinet	rferometry ed of sound for varie isentropic compre- ity of Lambert- Bee e concentration of solution. ex formation betwee ics	ous liquids essibility of er's Law fo copper sul en ferric ar	s. f liquids. or KMnO4 an phate, potas nd thiocyanat	d K2C1 sium p te ions.	r <sub>2</sub> O7 ermangai	nate and j	potassium
<ul> <li>To determ</li> <li>To determ</li> <li>To study</li> <li>solution u</li> <li>To study tl</li> <li>Brief Description</li> </ul>	the kine the	e activation energy e temperature coefficientics of reaction he clock reaction. etics of acid catalyz of self-learning / E	for the hydicient for t between red inversi	drolysis of et he hydrolysis potassium i on of cane su component	hyl or i s of eth odide igar.	methyl ac yl or met and pota	cetate. thyl aceta assium pe	te. ersulphate
		Δ		ponent	- 10			
Robe	NM .	A	10-	AR	9 1	-	1	

- 1. https://youtu.be/UG-pzCUsEq0
- 2. https://nptel.ac.in/courses/103108100/module2/module2.pdf
- 3. https://www.slideshare.net/TapeshwarYadav1/colorimeter-52697150
- 4. chemistry.bd.psu.edu/jircitano/kinetics.html

- 1. Khosla, B.D., V.C. Garg and A. Gulati. Senior Practical Physical Chemistry.
- 2. Thawale, A. and P. Mathur. Experimental Physical Chemistry.
- 3. Vishwanatha, B. and P. S Raghav. Practical Physical Chemistry.
- 4. Sindhu, P.S. Practical in Physical Chemistry.

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# Semester III Specialization: Organic Chemistry

Photochemistry a Reactions 17060313 use tick mark) .Sc. (Hons) hemistry or B.Sc. Non ledical/Medical) of Lectures, Tutoria tion: the study of organic ysical and photoch romagnetic radiation photochemical and p ves: the effect of EMR of he photochemical reac pericyclic reactions, eactions. erent types of rearrant tes (COs): is course, the student omenon of photochemical reactions	Core () 6. Frequence (use marks) Is,Practicals Tutorials = N c chemical reace termical processes n with organice pericyclic react n matter and here its types and the terminal processes n with organice pericyclic react n matter and here its types and the terminal processes	L 3 cy tick	DSI Even () Pr: the pro- be int ales. Th l be brid nical rea to rearra change	T 0 E 0 Odd () actical esence a troduce he invo efly disc actions p angeme during	S Either Sem() = Nil and abser d and el olvement cussed in proceed b nts different	P 0 SEC () EverySem () nce of light laborate the of different the course.
17060313         use tick mark)         .Sc. (Hons)         hemistry or B.Sc.         Non         ledical/Medical)         of Lectures, Tutoria         tion:         the study of organic         ysical and photoch         romagnetic radiation         photochemical and p         ves:         the effect of EMR or         ne photochemical read         pericyclic reactions,         eactions.         erent types of rearrant         tes (COs):         is course, the student         omenon of photoche	Core () 6. Frequence (use marks) Is,Practicals Tutorials = N chemical reace emical process n with organice pericyclic react n matter and how ction of alkene its types and ngement reaction ts will be able to	3 cy tick lil tions in ses will molecu ions will ow chem and phot MOs c n	DSI Even () Pra the pre be int ales. The lobe bride nical rea to rearra change	0 E () Odd () actical esence a troduce he invo efly disc actions p angeme during	Either Sem() = Nil and abser d and el lvement cussed in proceed b nts different	0 EverySen () nce of light laborate the of different the course.
use tick mark) .Sc. (Hons) hemistry or B.Sc. Non ledical/Medical) of Lectures, Tutoria tion: the study of organic ysical and photocher romagnetic radiation photochemical and p ves: the effect of EMR or he photochemical reac pericyclic reactions, eactions. erent types of rearrante to come of photocher is course, the student omenon of photocher pericyclic reactions	Core () 6. Frequence (use marks) Is,Practicals Tutorials = N c chemical reace emical process n with organic pericyclic react n matter and ho ction of alkene its types and ngement reaction ts will be able to	cy tick	DSI Even () Pra the pro- be int ales. Th l be bride nical rea to rearra change	E () Odd () actical esence a troduce he invo efly disc actions p angeme during	Either Sem() = Nil and abser d and el lvement cussed in proceed b nts different	EVerySen () EverySen () nce of light laborate th of different the course. by the action t types of
Sc. (Hons) hemistry or B.Sc. Non ledical/Medical) of Lectures, Tutoria tion: the study of organic ysical and photoch romagnetic radiation photochemical and p ves: the effect of EMR or he photochemical read pericyclic reactions, eactions. erent types of rearran tes (COs): is course, the student omenon of photoche	<ul> <li>6. Frequence (use marks)</li> <li>is,Practicals</li> <li>Tutorials = N</li> <li>chemical reacterical processes</li> <li>n with organic pericyclic reacterical processes</li> <li>n matter and here its types and the section of alkene its types and types and types are section of alkene its types and types are section of alkene its types are section of alkene its types and types are section of alkene its types are secting types are secting types are secting types ar</li></ul>	tick tick tions in ses will molecu ions will ow chem and phot MOs con	Even () Pratical real the problem ales. The be brid ales. The be brid to rearrance change	Odd () actical esence a troduce he invo efly disc actions p angeme during	Either Sem() = Nil and abser d and el olvement cussed in proceed b nts different	EverySen () nce of light laborate th of different the course.
tion: the study of organic ysical and photoch romagnetic radiation photochemical and p ves: the effect of EMR or e photochemical read pericyclic reactions, eactions. erent types of rearran tes (COs): is course, the student omenon of photoche	Is, Practicals Tutorials = N chemical reac emical process n with organic pericyclic react n matter and ho ction of alkene its types and ngement reaction ts will be able to	tions in ses will molecu- ions will ow chem and phot MOs c n	Pratical rearrange	actical esence a troduce he invo efly disc actions p angeme during	= Nil and abser d and el olvement cussed in proceed b nts different	nce of light laborate th of different the course. by the action t types of
tion: the study of organic ysical and photoch romagnetic radiation photochemical and p ves: the effect of EMR of the effect of EMR of pericyclic reactions, eactions. erent types of rearran tes (COs): is course, the student omenon of photoche	Tutorials = N chemical reac emical process n with organic pericyclic react n matter and ho ction of alkene its types and ngement reaction	tions in ses will molecu ions will ow chem and phot MOs c n	Pra the pro be int ales. Th l be brid nical rea to rearra change	actical esence a troduce he invo efly disc actions p angeme during	= Nil and abser d and el olvement cussed in proceed b nts different	nce of light laborate th of different the course. by the action t types of
tion: the study of organic ysical and photoch romagnetic radiation photochemical and p ves: the effect of EMR or pericyclic reactions, eactions. erent types of rearran tes (COs): is course, the student omenon of photoche	chemical reac emical process n with organic pericyclic react n matter and ho ction of alkene its types and ngement reaction	tions in ses will ons will ow chem and phot MOs c n	the probe introduces. The be introduced to be introduced by the brid state of the brid state of the brid state of the state of the brid st	esence a troduced he invo efly disc actions p angeme during	and abser d and el olvement cussed in proceed b nts different	nce of light laborate the of different the course. by the action t types of
the study of organic ysical and photoch romagnetic radiation photochemical and p ves: the effect of EMR of the effect of EMR of the photochemical read pericyclic reactions, eactions. erent types of rearran thes (COs): is course, the student omenon of photoche	chemical reac emical process n with organic pericyclic react n matter and ho ction of alkene its types and ngement reactio	tions in ses will molecu ions will ow chem and phot MOs c n	the pre- be int ales. Th l be brie nical rea to rearra change	esence a troduce he invo efly disc actions p angeme during	and abser d and el olvement cussed in proceed b nts different	nce of ligh laborate th of differer the course. by the action t types of
ward–Hoffmann rule	mistry. of alkenes, cart es governing per	oonyl and ricyclic r	d aroma reaction	atic con	npounds.	
nt types of rearranger	ment reactions					
ed content				•		
tions: Interaction of o d molecule, Ja tization, quantum /olmer plot, delayed Alkenes: Intramo cal energy transfer; dimerizations.	electromagnetic ablonski dia yield,solvent fluorescence. plecular reaction photochemical	e radiatio gram, effects, ons of Addition	on with energ transt the cons, cycl	matter, y po fer of blefinic isation,	types of ooling, excitati bond- rearrange	excitations exciplexes on energy geometrica
of lectures = 10	Title of the Aromatic con	unit: P npounds	Photoch s	emistry	y of Ca	rbonyl and
Carbonyl Compound clic and xadienones.Intermol	nds: Intramole acyclic,β,γ-ur ecular cycload	cular re nsaturate dition re	eactions d eactions	of ca and dimer	arbonyl α α,β isations a	compounds- -unsaturated and oxetan
	ed content of lectures = 10 tions: Interaction of d molecule, Ja tization, quantum Volmer plot, delayed Alkenes: Intramo cal energy transfer; dimerizations. of lectures = 10 Carbonyl Compou clic and exadienones.Intermol	ed contentof lectures = 10Title of the unitions: Interaction of electromagnetic d molecule, Jablonski dia tization, quantum yield,solvent Volmer plot, delayed fluorescence.Volmer plot, delayed fluorescence.Alkenes: Intramolecular reaction cal energy transfer; photochemical ;dimerizations.of lectures = 10Title of the Aromatic cor Carbonyl Compounds: Intramolecular cycload	ed contentof lectures = 10Title of the unit: Photions: Interaction of electromagnetic radiationidmolecule,Jablonskidiagram,tization,quantumyield,solventeffects,Volmer plot,delayedfluorescence.Alkenes:Intramolecularreactionsof lectures = 10Title of the unit:Aromatic compounds:CarbonylCompounds:Intramolecularexadienones.Intermolecularcyclic, $\beta,\gamma$ -unsaturateexadienones.Intermolecularcycloadditionreaction	ed contentof lectures = 10Title of the unit: Photochemtions: Interaction of electromagnetic radiation with ad molecule, Jablonski diagram, energy tization, quantum yield, solvent effects, trans Volmer plot, delayed fluorescence.Volmer plot, delayed fluorescence.Alkenes: Intramolecular reactions of the or cal energy transfer; photochemicalAdditions, cycle; dimerizations.Totle of the unit: Photoch Aromatic compoundsAromatic compoundsCarbonyl Compounds: Intramolecular reactions clicacyclic, $\beta, \gamma$ -unsaturated exadienones.Intermolecular cycloaddition reactions	ed contentof lectures = 10Title of the unit: Photochemistrytions: Interaction of electromagnetic radiation with matter, d molecule, Jablonski diagram, energy po- tization, quantum yield,solvent effects, transfer of Volmer plot, delayed fluorescence.Alkenes: Intramolecular reactions of the olefinic cal energy transfer; photochemicalAdditions, cyclisation, ;dimerizations.of lectures = 10Title of the unit: Photochemistry Aromatic compoundsCarbonyl Compounds: Intramolecular reactions of ca clic and acyclic, $\beta,\gamma$ -unsaturated and exadienones.Intermolecular cycloaddition reactions-dimer	ed contentof lectures = 10Title of the unit: Photochemistrytions: Interaction of electromagnetic radiation with matter, types of d molecule, Jablonski diagram, energy pooling, itization, quantum yield, solvent effects, transfer of excitati Volmer plot, delayed fluorescence.Alkenes: Intramolecular reactions of the olefinic bond- cal energy transfer; photochemicalAdditions, cyclisation, rearrange ;dimerizations.of lectures = 10Title of the unit: Photochemistry of Ca Aromatic compoundsCarbonyl Compounds: Intramolecular reactions of carbonyl of clic and acyclic, $\beta, \gamma$ -unsaturated and $\alpha, \beta$

#### formation.

Photochemistry of Aromatic Compounds: Isomerization, skeletal isomerizations, Dewar and prismanes in isomerization. Additions and substitutions.

Miscellaneous Photochemical Reactions: Photo-Fries rearrangement of ethers and anilides, Barton reaction. Singlet molecular oxygen reactions. Photodegradation of polymers, Hoffman-Loefller-Freytag reaction.

#### Unit – 3 Number of lectures = 10 Title of the unit: Pericyclic Reactions

General pericyclic selection rule and its applications, Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions, Woodward – Hoffmann correlation diagrams, FMO and PMO approach, Hückel–Mobius approach Electrocyclic reactions – conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems

Cycloadditions – antarafacial and suprafacial additions, 4n and 4n+2 systems with a greater emphasis on (2+2) and (4+2) cycloaddition-stereochemical effects and effects of substituents on the rates of cycloadditions, 1,3-dipolar cycloadditions and cheleotropic reactions.

### Unit – 4 Number of lectures = 10 Title of the unit: Sigmatropic Rearrangements

Sigmatropic Rearrangements-suprafacial and antrafacial shifts [1,2]-sigmatropic shifts involving carbon moieties retention and inversion of configuration, (3,3) and (5,5) sigmatropic rearrangements, detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-cope rearrangements, introductions to Ene reactions, simple problems on pericyclic reactions. Electrocyclic rearrangement of cyclobutenes and 1,3-cyclohexadienes. Chelotropic rearrangements

#### 12. Brief Description of self learning / E-learning component

- 1. http://nptel.ac.in/courses/104105038/
- 2. http://assets.vmou.ac.in/MSCCH06.pdf.

- 1. Organic Photochemistry <u>Charles Herbert DePuy</u> (Author), <u>Dennis Chapman</u> (Author), Prentice Hall (1 June 1972), **ISBN-13:** 978-0135995716
- Aspects of Organic Photochemistry W.M. Horsepool, Academic Press (1976), ISBN-13: 978-0123566508
- Organic Photochemistry. Coxon, J.M and Halton, B., Cambridge University Press; 2 edition (3 March 2011) ISBN-13: 978-0521189729
- Pericyclic Reactions: A Mechanistic Study, Mukherji, S.M., Macmillan India Press, ISBN 13: <u>9780836406375</u>
- 5. Principles of Molecular Photochemistry An Introduction, N.J. Turro, J.C. Scaiano, V. Ramamurthy, ISBN-13: 978-1891389573





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	Course N	ame	Heterocycl Synthesis	ic Chen	nistry and Organic	L		Т	Р
3.	Course C	ode	17060314			3		0	0
4.	Type of C	Course	(use tick ma	ark)	Core (🖌)	DSI	ΞO	SF	CO
5.	Pre- requisite (if any)	B C (1 M	.Sc. hemistry o Jon ledical/Medi	(Hons) r B.Sc. cal)	6. Frequency (use tick marks)	Even ()	Odd (🖌	Either Sem ()	Every Sem (
7.	<b>Total Nur</b>	nber o	f Lectures,	Tutorials	, Practicals				
Lee	tures = 4	0			Tutorials = Nil	Practic	cal = N	il	
8.	Course I	Descrip	tion:						
dru des 9. The	g molecule ign the path Course ( objective	s. This hway for <b>Object</b> of this	course also or the synthe ives: course is	covers th esis ofdrug	e disconnection approa g molecules and natural	ch which product	s.	ates the cl	hemists
2. 3. 4. 0. ( Afte 1 D 2. E 3. A 4. A	To explain To describ To discuss Course Ou er completi esign the h Design and apply differ	the reaction of the terrory synthest reaction of terrory	action mecha uidelines for portant nam s (COs): his course, s velic organic size fused rin me reactions	anisms of r choosing e reaction students w compour ng heteroor s in the syn	heterocyclic compound g disconnections in cher as widely used in organi rill be able to nds cyclic compounds nthesis of natural produ	ls nical syr c synthe	nthesis sis		
11.	Unit wise	detaile	d content	leetion up	prouen				
Uni	t-1	Numb	er of lecture	es = 10	Title of the unit: Five	-membe	ered H	eterocycle	es
Syn and	thesis and benzo fuse	reactio ed anal	ns of Five m ogs: indole,	embered benzofura	rings with two heteroat	oms: imi	idazole	, oxazole,	thiazole
Uni	t-2	Numb	er of lecture	es = 10	Title of the unit: Six	-membe	red He	eterocycle	s
Syn	thesis and	reactio	ons of six m	embered	rings: Pyridine, Pyrazi	ne and E	Benzofi	used six n	nembere
ing	s with one.	, two ai	nd three hete	eroatoms:	benzopyran, quinoline,	and acri	dine		
Uni	t-3	Numb	er of lecture	es = 10	Title of the unit: products	Name	Reaction	ons and	Natura
	have in an	nd app	blications o b Diels – A	f name Ider Stor	reactions:Aldol, Perki	n, Benz d Micha	oin, C	Cannizarro	, Witti
Mec Ref Che	ormatsky, l mistry of i idation)	Mannic natural	products: A	lkaloids,	Terpenoids, and Steroi	ds (Gen	eral me	ethods of	structura
Mec Ref Che eluc Uni	$\frac{1}{1}$	Mannic natural Numbe	products: A	lkaloids, es = 10	Terpenoids, and Steroi Title of the unit: Dis	ds (Gene	eral me	ethods of proach	structur

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choosing disconnections, Functional group interconversions.

**One group C-C Disconnections:** Synthesis of alcohols and carbonyl compounds by 1,1 C-C disconnections, synthesis of alcohols and carbonyl compounds by 1,2 C-C disconnections.

Regioselectivity in Michael reactions, Alkene synthesis by Wittig reaction, use of acetylenes (alkynes) and aliphatic nitro compounds in organic synthesis.

**Two group C-C Disconnections:** Diels Alder reaction: stereospecificity and stereoselectivity, endo selectivity, regioselectivity. 1,3-dicarbonyl compounds, Michael addition and Robinson annulation.

# 12. Brief Description of self-learning / E-learning component

- 1. http://nptel.ac.in/syllabus/104105034/
- 2. http://bhavanscollegedakor.org/images/pdf/sci/disconnetcion.pdf.
- 3. https://onlinecourses.nptel.ac.in/noc18\_cy03/preview.

- Singh, J., Yadav, L.D.S. and Singh J. Organic synthesis (2018), PragatiPrakashan, 14<sup>th</sup> Edition, ISBN: 978-93-87812-50-5
- Ahluwalia, V.K. Heterocyclic Chemistry(2016), revised edition, Narosa Publishing House, ISBN: 978-8184875591
- 3. Gupta, R.R., M. Kumar and V. Gupta. Heterocyclic Chemistry, Volume II: Five-Membered Heterocycles (1999), Springer, ISBN 978-3-662-07757-3
- 4. Organic Chemistry, Finar, I.L. Volume 1, 6th Edition, Pearson, ISBN: 978-81-7758-542-1
- Organic synthesis : The Disconnection Approach(2008), Sturant Warren, Paul Wyatt, 2<sup>nd</sup> Edition, Publisher: Wiley, ISBN: 978-0-470-71236-8
- 6. Advanced Organic Chemistry, Parts A & B, Carey, F.A. &Sundberg, R. J. Plenum: U.S. (2004).
- 7. Modern Methods of Organic Synthesis, Carruthers, W. Cambridge University Press (1971).
- Introduction to the Chemistry of Heterocyclic Compounds, Acheson, R. M. John Wiley &Sons(1976).

2. Cours	e Name	Reagen	ts and Rear	rangements	L	Т		Р
3. Course	e Code	170603	15		3	0	,	0
4. Type of	of Course	(use tick r	nark)	Core (🖍	D	SE ()	SE	C 0
5. Pre- requis (if any	ite Cl (N M	Sc. nemistry lon edical/Me	(Hons) or B.Sc.	6. Frequency (use ti marks)	ck ()	Odd ()	Either Sem ()	Every Sem ()
7. Total I	Number of	Lectures	s, Tutorials	, Practical				
Lectures =	= 40			Tutorials = Nil	I	Practical	= Nil	
8. Course	e Descript	ion:						
This cours reagents. In compound	e is design provides s	ed for stud sound kno	dents to acq wledge of o	uire knowledge in d different molecular	organic tra rearrange	ansformation ments in	tions using synthesis o	g differen of organi
9. Course	e Objectiv	es:				0.1		-
<ol> <li>To stud</li> <li>To stud</li> <li>To stud</li> <li>To stud</li> <li>To disc</li> </ol>	ly the prep ly the prep ly the prep uss differe	aration,pro aration,pro aration,pro	operties and operties and operties and llar rearrang	applications of org applications of oxi applications of red gements.	anometal dizing ag ucing age	nts	nts	
to. Course	Outcome	es (COs):						
<ol> <li>To app</li> <li>Apply</li> <li>Unders</li> <li>Construct</li> </ol>	ly the use of different re- tand the no- act efficient	of organor eagents in eed to stud t, simple i	netallic reagent the organic ly molecula mechanistic	gents in organic syn transformations. r rearrangements. pathways for the sy	thesis ynthesis o	f a given	compound	1
1. Unit wi	se detailed	content			-			5
Unit-1	Number	• of lectur	es = 10	Title of the unit:	Organom	etallic R	eagents	
details. Organo m reagents, ( Palladium	agnesium Organo bo reagents.	reagents, pron reage	Organo co ents, Organ	opper reagents, Or no tin reagents, C	gano zino gano si	c reagen licon rea	ts, Organo agents and	o lithiur l Organ
Unit $-2$	Number	of lectur	es = 10	Title of the unit: (	Oxidation	L		
Preparation details. DDQ, Selin Cr(VI) oxi acetate and aminohydro	i, propertie nium dioxi dants, DM thallium ( oxylation.	es and app de, Peraci SO oxida III) nitrate	ds, Prevost nts, Manga e.Sharpless	following reagents Oxidations, Osmiun nese dioxide, Silver Asymmetric epoxid	in organi m teraoxic r Carbona ation, Asy	c synthes de, Potass ite, Perio ymmetric	sis with mo sium perm dic acid, I hydroxyla	anganate Lead tetration and
Unit – 3	Number	of lectur	es = 10	Title of the unit: I	Reduction	1		
Preparation details of C Sodium cya	, propertie atalytic hy anoborohy	s and appl drogenati dride, Ala	lications of ons, Lithiur nes and Bor	following reagents n aluminiumhydride ranes, and Diimide	in organic e and sodi reductions	synthesi um borol	s with mee hydride, D	chanistic IBAL-H
Unit – 4	Number	of lectur	es = 10	Title of the unit: N	Molecular	r rearran	gements	
R	have.		A	Ý	to	h	- W	-

Definition and classification. Molecular rearrangements involving 1) electron deficient carbon: Wagner- Meerwein, Pinacol-Pinacolone, Allylic and Wolff Rearrangement. 2) electron deficient Nitrogen: Hofmann, Lossen, Curtius, Schmidt and Beckmann rearrangements 3) electron deficient Oxygen: Baeyer-Villiger oxidation. 4) Base catalysed rearrangements: Benzilic acid, Favourski, Trans annular, Sommlett-Hauser and Smiles rearrangement.

# 12. Brief Description of self learning / E-learning component

- 1. http://nptel.ac.in/course.php.
- 2. http://www.chem.iitb.ac.in/~kpk/ra.pdf
- 3. https://nptel.ac.in/courses/104101005/downloads/LectureNotes/chapter%2011.pdf

- Organic Synthesis Concepts, Methods and Starting Materials, Fuhrhop, J.-H. and Penzilin, G... Vch Pub (May 1997), ISBN-13: 978-1560818144
- Some Modern Methods of Organic Synthesis, Carruthers, W. Cambridge University Press; 3 edition (January 30, 1987), ISBN-13: 978-0521311175
- 3. Modern Synthesis Reactions, House, H.O. and W.A. Benjamin. w. a. benjamin; 2nd edition (1972), ISBN-13: 978-0805345018
- Advanced Organic Chemistry Jerry March, John Wiley & Sons Inc; 3rd edition, ISBN:978-0471854722
- 5. Principles of Organic Synthesis, Norman, R.O.C. and Coxon, J.M. Springer; Softcover reprint of the original 3rd ed. (1993)
- 6. Advanced Organic Chemistry: Part B: Reaction and Synthesis, Carey, F.A. and R.J. Sundburg. Springer; (2008), ISBN-13: 978-0387683546
- Organic synthesis : The Disconnection Approach (2008), Sturant Warren, Paul Wyatt, 2<sup>nd</sup> Edition, Publisher: Wiley, ISBN: 978-0-470-71236-8

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2. Course Na	mo	Organia Sa	equal Practical I	т	T		D
s pullen .	de de	Organic Sp	ectal Practical –1		1		4
5. Course Co	ae	17060316		0	0	-	4
4. Type of Co	ourse (use tio	k mark)	Core (V)	DS	E O	SE	C ()
8. Pre- requisite (if any)	B.Sc. (Hor Chemistry (Non Medical/M	ns) or B.Sc. ledical)	9. Frequency (use tick marks)	Eve n ()	Od I d e O S	Eith er Sem )	Eve y Sen ()
7. Total Num	ber of Lectu	res, Tutoria	ls, Practicals				2
Lectures = Nil			Tutorials = Nil	Р	ractical	= 52	
. Course De	scription:						
Course Of To make stu To learn the To learn the To learn the	ojectives: adents able to e methods for e estimation of e method of e	o carry out or their separa of organic co extraction of	ganic isolations of natural tion and purification. mpounds. natural products.	products			2.4
<ol> <li>Course</li> <li>Jpon successfu</li> <li>Apply the a</li> <li>Design and laboratory a</li> <li>Solve most</li> <li>Develop me</li> </ol>	Outcomes ( I completion pplication of apply the a and research of important pr ethods for ext	COs): of this cours analytical m nalysis relat of the scienti oblems of qu traction of na	se, the student will be able ethods based on titrations, ed to a question of releva fic literature antitative analysis. tural products.	to: isolation, sep ance based o	parations on exper	, etc ience	in t
1. List of Exp	eriments						
Isolation of nat	aral products ation of caffe	: ine from tea	1				

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#### Students need to perform a total 10 experiments in all.

## 12. Books Recommended

- Vishnoi, N. K., Advanced Practical Organic Chemistry, 3<sup>rd</sup> edition, ISBN: 9788125931287, 9788125931287
- 2. Brian S, Furniss, A.J. Hannaford, Peter W.G. Smith and Tatchell, A. R., Vogel's Textbook of
- 3. Practical Organic chemistry, 5th edition, John Wiley & Sons, New York, ISBN:0582462363
- 4. Natural Products Isolation, Editors: Sarker, Satya D. (Ed.), ISBN 978-1-59259-955-4.

#### E link:

- 1. <u>https://www.youtube.com/watch?v=Gexf\_PNPefU</u>
- 2. https://www.youtube.com/watch?v=9tcErJzejUY
- 3. https://www.youtube.com/watch?v=ZtMwjEnglMo
- 4. https://www.youtube.com/watch?v=qzfFajukhTU
- 5. https://www.n-analytech.co.jp/archives/003/201602/ApplicationSheet GT-200-OF032E.pdf

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	Course Name	Organic Special Practical II	L			Т	Р
3.	Course Code	17060317	0			0	4
4.	Type of Course	e (use tick mark)	Core (c	DSF	EO	SF	C O
5. 1	Pre-requisite	B Sc (Hons)	6 Frequency	Even	Ddd	Fither	Every
	(if any)	Chemistry or B.Sc. (Non Medical/Medical)	(use tick marks)	0	( <b>v</b> )	Sem ()	Sem
7.	<b>Total Number</b>	of Lectures, Tutorials,	Practical			1	
Leo	ctures = 0		Tutorials = 0	Pra	actical =	= <b>78</b>	ē
8.	<b>Course Descrip</b>	otion:					4
pro alsc 9. The 1. 2. 3. 4. Up( 1. 2. 3	cesses and will e o give a platform <b>Course Object</b> e objectives of th Perform the star Plan and carry of Measure and rep Handle organic <b>Course Outcon</b> on successful con Describe variou Describe dispos	enable them to develop to develop different me ives: is course are to: adard techniques used in out a multi-step synthesi port relevant physical pr chemicals safely and de nes (COs): mpletion of this course, is techniques used for sy sal techniques and labor ling of instruments	and practice independ ethods to synthesize or a practical organic cher s using a prescribed pr coperties of prepared co escribe their potential d the student will be abl ynthesis of organic cor ratory emergency proce	ent learni ganic cor mistry. ocedure. ompound angers. e to: npounds. edures.	s.	ls. This co	ourse w
4. 11. Ad	Apply purificat List of Experin vanced Multiste	ion techniques for the p nents p synthesis :	urification of organic of	compound	ds		
1. 2. 3. 4. C (Or <b>No</b> 1	Benzaldehyde – Benzophenone – Benzaldehyde – Cyclohexanone – ) other suitable r te: Students nee	→ Bezoin → Benzil → H → benzopinacol → benz → chalcone → chalcone → cyclohexanone oxime nulti-step synthesis d to perform at least 5	Benzilic acid zopinacolone. epoxide $e \rightarrow$ caprolactone <b>experiments in all.</b>				
12.	<b>Books Recomm</b>	ended					
	<ol> <li>Chapman an</li> <li>Nicolas Bo experiments</li> <li>Vogel's Text B.S. Furnis;</li> <li>Vishnoi, N.</li> </ol>	d Hall, 5th edition, Text ogliotti, RobaMoumné J.Dec 2017.ISBN: 9783 book Of Practical Orga A.J. Hannaford; P.W.G K., Advanced Practical	tbook of Practical Org Multi step organic 527340651. nic Chemistry (5th Ed Smith, ISBN 13: 978 Organic Chemistry, 3	anic Cher synthe ition)by 2 0582462.	mistry, esis, A A.I. Vo 366 n, ISBN	1996. guide gel; A.R.	throug Tatchel

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- 2. https://www.youtube.com/watch?v=1sjtTV7WGMI
- 3. http://publications.rwth-aachen.de/record/459429/files/2681.pdf
- 4. https://www.youtube.com/watch?v=2pxBqBBAuwo
- 5.https://www.youtube.com/watch?v=9bElvg9t13k

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	Name	Organic Special P	ractical –III	L		Т	P
3.Cours	e Code	17060318		0		0	4
4. Type	of Cour	se (use tick mark)	Core (✔)	DSE ()		SEC ()	
5. Pre- requi (if a)	site (H ny) B M	.Sc. Ions) Chemistry or .Sc. (Non Iedical/Medical)	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem (
7. Total	Number	of Lectures, Tutoria	als, Practical			1	
Lectures	= 0		Tutorials = 0	Pra	ectical	= 52	
8. Cou	rse Desci	ription:					
oxidation skills. The compound	/reductionis cours	n reactions and will e will also give a p	enable them to develop platform to learn different	and pra ent reage	ctice in ents to	ndepender synthesiz	nt learnin ze organ
9. Cou	rse Obje	ectives:					
. Perfo 2. Plan a 3. Learn 4. Hand 5. Use t	rm the sta and carry the vario le organio ne referer	andard techniques use out various oxidation ous reagents of organic c chemicals safely and nee material found in t	d in practical organic che /reduction reactions throu c chemistry. l describe their potential the laboratory.	emistry. ugh mode dangers.	ern me	thods.	
0. Cour	se Outco	mes (COs):					
<ol> <li>Desc</li> <li>Desc</li> <li>Desc</li> <li>Know</li> <li>Preparation</li> <li>Preparation</li> </ol>	ribe vario ribe dispo w the han are himse of Experi	bus reagents used for s osal techniques and la dling of different cher lf/herself according to ments	synthesis of organic comp boratory emergency proc nicals and instruments. the modern research fie	pounds. edures. ld.	54 		
Organia	wnthesis						
<ol> <li>Prote /keto</li> <li>Oxid</li> <li>Redu bond</li> <li>Meta</li> <li>Diels</li> <li>Diaz</li> <li>Note : Stepracticed</li> </ol>	ection and nes, etc. ation read action read s, nitro ls/ metal -Alder re otisation udents n while p	deprotection reaction ctions of alcohols, ald actions of aldehyd compounds salts catalyzed couplinations reactions reactions for substitution eed to perform at le	as of carboxylic acids, am ehydes, etc. es/ ketones, carboxyli- ng reactions ions and couplings <b>ast 10 experiments (Gr</b> <b>ments)</b> .	nines, alco c acids, reen cher	ohols, carbo nistry	1,2- diols, on-carbon <b>techniqu</b>	aldehyd multip es may l
2. Book	s Recom	mended			14		
. Chapr 2. Nicol	nan and H as Boglio ISBN: 9'	Hall, 5th edition, Textl tti, RobaMoumné, Mu 783527340651. ok Of Practical Organ	book of Practical Organic Ilti step organic synthesis	c Chemis , A guide	try, 19 throug	96. gh experim	ients, .De

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## E link:

- 1. <u>https://www.youtube.com/watch?v=HTxa7-oqvew</u>
- 2. https://www.youtube.com/watch?v=XLrDBM-Eluw
- 3. https://www.youtube.com/watch?v=LQ4sdDSFE3U
- 4. https://www.youtube.com/watch?v=HdvrTQpzfjc
- 5. https://www.youtube.com/watch?v=xYvzciNQiao

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1.	Name of the De	partment : Depart	ment of Chemist	ry			
2.	Course Name	Drug Design and I	Development	L	T		Р
3.	Course Code	17060319		2	0		0
4.	Type of Course	(use tick mark)	Core ()	DSE (	)	SE	<b>C</b> 0
5.	Pre-requisite (if any)	B.Sc. (Hons) Chemistry or B.Sc. (Non- Medical)	6. Frequency (use marks)	tick Even ()	Odd (✔)	Either Sem ()	Every Sem ()
/•	Total Number o	Thectures, Tutoria	ais, Practicals				
Le	$\frac{\text{ctures} = 26}{2}$	•	Tutorials = Nil	Practi	cal = Nil		
8.	Course Descript	tion:					
var pro des stu 9. 1. 2. 3.	ious drug recepto drugs with their a ign will also be o dy. Finally, Comp Course Objecti This course will It will present du computer-based o Students will lean applied to the dev	ors will be explained applications in drug discussed. Role of ( outer aided drug desi ves: explore the process rug development as methods and combin rn about molecular r velopment of new m	d. Various concept design will be ex QSAR studies and ign and Pharmaco of drug developm a process involve natorial chemistry recognition, computedicines.	ots such as iso xplained. Role I molecular pro- ophore modelin ent from targe ing target sele /high-throughp uter aided drug	sterism, bi of stereose operties wi ng will be e t identifica ection, lead out screenin g design, an	tion discover discover discover discover discover discover discover	rism and in drug e part of ry using logy as
4.	To acquaint stude	ents with deep know	ledge about drug	receptors			
10.	Course Outcom	es (COs):					
Stu 1. I che 2. 3. U 4. A 11. Uni	dents will be able Develop an unders mical structure of Identify new drug Jnderstand the key Apply knowledge Unit wise detailed	to: standing of drug targ a substance influen targets for future dr y concepts of drug d to QSAR and molec ed content	gets as a recognition rug discovery. lesign. cular properties in <b>Title of the unit</b>	on site for pha ith a drug targe designing of r : Drug Recen	rmaceútica et new drugs. tors	l agents;	how the
Bas	ic concept and	classification of red	ceptors, Forces i	nvolved in di	ug recento	ors- inter	actions
Rec Top H-2	ceptor agonism oographical study receptors.	and antagonism, of the following re	Concept of Spaceptors: Adrenerg	are receptors, gic, Cholinergi	Ion Cha c, Opioid	annel re receptors	ceptors, , H-1 &
Uni	it – 2 Number	of lectures = 6	Title of the unit	: Drug Design	1		
Cor app	ncept of isosteris roach to drug de	m and bioiososteris sign, Analog drug	sm and their app design, Prodrugs.	lications in d	rug design ways of d	, Antime rug meta	tabolite

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Stereochemical aspects of drug actionUnit - 3Number of lectures = 7 Title of the unit: QSAR and Molecular properties in

Allon .

JUD9 0

	drug design
Basic intro	oduction of QSAR and its Applications in drug design
Molecular	modeling: Prediction and analysis of ADMET properties of new molecules and its
importanc	e in drug design.
Basics of discovery.	combinatorial chemistry, Rational approach to drug design, Basic strategies of drug
Unit – 4	Number of lectures = 7 Title of the unit: Computer aided drug design and
	Pharmacophore modeling
Introductio	on to computer aided drug design (CADD)
Physicoch	emical parameters and methods to calculate them: Hammett equation and electronic
parameters	(sigma), lipophilicity effects and parameters (log P, $\pi$ -substituent constant), steric
effects (1a	It steric and molar refractivity). Biological parameters.
Introductio	on to Pharmacophore modelling.
11.Brief L	escription of self-learning / E-learning component
1. https://	www.ncbi.nlm.nih.gov/pmc/articles/PMC4975341/
2. https://	nptel.ac.in/noc/individual_course.php?id=noc18-bt28
3. <u>https://</u>	nptel.ac.in/courses/102106065/58
12. Books	Recommended
1. Manfre Wiley-	d E. Wolff, Burger's medicinal Chemistry and Drug Discovery, Vol. I to V, 5thed., A Interscience publication John Wiley & Sons, Inc. (New York), 1995.
2. Willian Mumba	n O. Foye, Principles of Medicinal Chemistry, 3rd ed., Varghese Publishing House, ai, 1989.
<ol> <li>Kadam Prakasl</li> </ol>	& Mahadik, Bothara, Principles of Medicinal Chemistry vol. I & II, 4th ed. Nirali Pune, 1997.
4. Leach	A., Molecular Modeling: Principles and Applications, Pearson, New York.
5. Langer VCH, V	T., Hoffmann R.D., Pharmacophores and Pharmacophore Searches, Volume-32, Wiley- Weinheim.
6. Perun Prakasl	J. and Propst C.L., Computer-aided Drug Design Methods and Applications, Saurabh an Pvt.Ltd., New Delhi.

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