B.Sc. CHEMISTRY

CHOICE BASED CREDIT SYSTEM (CBCS)

Syllabus
2021-2022

Enable | Enlighten | Enrich
KARPAGAM
ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

DEPARTMENT OF CHEMISTRY

FACULTY OF ARTS, SCIENCE AND HUMANITIES

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
(Established under section 3 of UGC Act, 1956)
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Eachanari Post, Coimbatore - 641 021, India
FACULTY OF ARTS, SCIENCE AND HUMANITIES
UNDER-GRADUATE PROGRAMMES
REGULAR MODE
REGULATIONS - 2021

The following Regulations are effective from the academic year 2021-2022 and are applicable to candidates admitted to Under Graduate Degree (UG) programmes in the Faculty of Arts, Science, and Humanities, Karpagam Academy of Higher Education (KAHE) from the academic year 2021-2022 onwards.

1 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

1.1 U.G. Programmes Offered

A candidate may undergo a programme in any one of the under graduate programme approved by the KAHE as given below.

S. No.	DEGREE	DISCIPLINE
1	B. Sc.	Biochemistry
2	B. Sc.	Biotechnology
3	B. Sc.	Computer Science
4	B.Sc.	Mathematics
5	B.Sc.	Physics
6	B. Sc.	Chemistry
7	B. Sc.	Microbiology
8	B. Sc.	Information Technology
9	B. Sc.	Computer Technology
10	B.Sc.	Computer Science (Cognitive Systems)
11	B.Sc.	Computer Science (Artificial Intelligence and Data Science)
12	BCA	Computer Application
13	B.Sc.	Applied Science (Material Science)
14	B.Sc.	Applied Science (Foundry Science)
15	B. Com.	Commerce
16	B.Com (CA)	Commerce with Computer Applications
17	B. Com. (PA)	Commerce with Professional Accounting

18	B. Com. (BPS)	Commerce with Business Process Services
19	B.B.A.	Business Administration
20	B. Com	Financial Analytics
21	B. Com	International Accounting and Finance

1.2 Mode of Study

Full-Time

All programs are offered under Full-Time Regular mode. Candidates admitted under '**Full-Time'** should be present in the KAHE during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

1.3 Admission Requirements (Eligibility)

A candidate for admission to the first year of the UG Degree programme shall be required to have passed the Higher Secondary Examination (10 + 2) [Academic or Vocational] prescribed by the Government of Tamil Nadu Board or any similar examination of any other Board accepted by the KAHE as equivalent thereto (Annexure I).

2. DURATION OF THE PROGRAMMES

2.1 The minimum and maximum period for the completion of the U.G. Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
B.Sc., B.Com, BCA, BBA	6	12

2.2 Each semester normally consists of 90 working days or 450 Instructional hours of study. Examination shall be conducted at the end of every semester for the respective courses.

3. CHOICE BASED CREDIT SYSTEM

3.1. All programmes are offered under Choice Based Credit System with a total credit of 140 for UG Programmes.

3.2. Credits

Credit means the weightage given to each course by the experts of the Board of Studies concerned. Total credits 140 as per UGC Guidelines for the UG programme (Three Years).

4. STRUCTURE OF THE PROGRAMME

4.1 Tamil or any one of the Indian / Foreign Languages *viz,* Malayalam, Hindi, Sanskrit, French are offered as an additional course for Arts & Science

Programmes. Four credits are awarded for each course and the examinations will be conducted at the end of each semester.

4.2. Core Course, Discipline Specific Elective, Generic Elective, Skill Enhancement Course, Project, Ability Enhancement Course are part of curricular structure.

4.2.1. Core Course

Core course consists of theory and practical for Department domains for which examinations shall be conducted at the end of each semester. The students have to study 12 Core Courses compulsorily. Students have to earn 77 Credits in Core Course.

4.2.2. Discipline Specific Electives (DSE)

DSE is offered in the fifth and sixth semesters of third year. The examination shall be conducted at the end of each semester. Final year students (V and VI Semesters) will have to choose the elective courses in V semester and VI Semester from the list of elective courses given in the curriculum, in addition to the project work. Students have to earn 6 Credits in Discipline Specific Electives.

4.2.3. Generic Elective

Generic elective is an elective course chosen generally from an unrelated discipline/subject, with an intention to provide exposure in other areas of interest also to students.

The students have to choose two Generic Electives- one each in the First year (3 or 4 courses) and second year (3 or 4 courses) of the programme from the list of elective courses given in the curriculum.

Note: A particular elective course will be offered only if at least one third of the students in a class choose that course. If less, the elective selected has to be studied as a self-study course only. Students have to earn 22 Credits in Allied Courses.

4.2.4. Skill Enhancement Courses

Skill Enhancement Courses are offered in the third and fourth semesters of second year programme and in the fifth and sixth semesters of the third year programme. Second year students (III and IV Semesters) will have to choose atleast one elective course each in both III and IV Semesters from the list of elective courses given in the curriculum. Similarly final year students (V and VI Semesters) will have to choose at least one elective course each in both V and VI Semesters from the list of elective courses given in the curriculum. The examination shall be conducted at the end of each semester. Students have to earn 16 Credits in Skill Enhancement Courses.

Note: A particular elective course will be offered only if at least one third of

the students in a class choose that course. If less, the elective selected has to be studied as a self-study course only.

4.2.5. Project Work

The project work shall start at the beginning of sixth semester and the Project Report has to be submitted at the end of the sixth semester. The project may be an individual or group task**.** The Head of Department concerned shall assign a project supervisor who in turn shall monitor the project work of the student(s). A project/ dissertation work may be given *in lieu* of a discipline-specific elective paper. Maximum number of students per project batch is 4.

4.2.6. Ability Enhancement Course

Ability Enhancement Course-1

The course (English I & II for Science Programmes / Communicative English I & II for Arts Programmes) shall be offered during the first and second semester for which examinations shall be conducted at the end of the semester. Four credits are awarded for each course and the examinations will be conducted at the end of each semester.

Ability Enhancement Compulsory Course-2

Students shall study the course Environmental Studies in the First / Second Semester for which examinations shall be conducted at the end of the semester.

4.2.7. Internship

The student shall undergo 15 days internship in the end of II and IV semester.

5.0 Value Added Courses

Courses of varying durations but not less than 30 hours which are optional and offered outside the curriculum that add value and help the students for getting placement. Students of all programmes are eligible to enroll for the value-added courses. The student can choose one Value-added course per semester from the list of Value-added courses available in KAHE. The examinations shall be conducted at the end of the value added course at the Department level and the student has to secure a minimum of 50% of marks to get a pass. The certificate for the value added course for the passed students shall be issued duly signed by the HOD and Dean of the Faculty concerned.

6.0 Online Course

Student shall study at least one online course from SWAYAM / NPTEL / MOOC in any one of the first five semesters for which examination shall be conducted at the end of the course by the respective external agencies if any. The student can register to the courses which are approved by the Department. The student shall produce a Pass Certificate from the respective agencies before the end of the fifth semester. The credit(s) earned by the students will be

considered as additional credit(s) over and above the credits minimum required to earn a particular degree.

7.0 Extension Activities

Every student is encouraged to participate in at least any one of the following Extension activities:

- NSS
- NCC
- Sports / Mass drill
- YRC
- Club activities
- Other Co-curricular and Extra curricular activities

The student's performance shall be examined by the staff in-charge of Extension Activities along with the faculty mentor and the Head of the respective department on the following parameters.

- 75 % weightage for active participation in Extension Activities in / out of the KAHE.
- 25 % weightage for Exemplary Awards / Honours / Prizes secured.

8.0 Marks for Co-curricular and Extra-curricular shall be sent to the CoE before the commencement of the Sixth End Semester Examinations.

The above activities shall be conducted outside the regular working hours of the KAHE.

5. MEDIUM OF INSTRUCTION

The medium of instruction and examinations for the courses under Language I – Tamil / Hindi / Malayalam / French / Sanskrit shall be in the language concerned. For all other courses, the medium of instruction and examination should be in English.

6. MAXIMUM MARKS

Each of the theory and practical courses shall carry a maximum of 100 marks. Out of which 40 marks is awarded for Continuous Internal Assessment (CIA) and 60 marks for End Semester Examinations (ESE).

Evaluation: Evaluation in the courses comprises two parts, one is the Continuous Internal Assessment (CIA) and the other one is the End Semester Examination (ESE).

7. REQUIREMENTS TO APPEAR FOR THE END SEMESTER EXAMINATION

a. Ideally, every student is expected to attend all classes and should secure 100% attendance. However, in order to allow for certain unavoidable circumstances, the student is expected to attend at least 75% of the classes and the conduct of the candidate has been satisfactory during the course.

b. A candidate who has secured attendance between 65% and 74% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) or due to participation in University / District / State / National / International level sports or due to participation in Seminar / Conference / Workshop / Training Programme / Voluntary Service / Extension activities or similar programmes with prior permission from the Registrar shall be given exemption from prescribed minimum attendance requirements and shall be permitted to appear for the examination on the recommendation of the Head of Department concerned and Dean to condone the shortage of attendance. The Head of Department has to verify and certify the genuineness of the case before recommending to the Dean concerned. However, the candidate has to pay the prescribed condonation fee to the KAHE.

c. However, a candidate who has secured attendance less than 64% in the current semester due to any reason shall not be permitted to appear for the current semester examinations. But he/she will be permitted to appear for his/her supplementary examinations, if any and he/she has to re-do the same semester with the approval of the "Students' Affairs Committee" and Registrar.

8. a. FACULTY MENTOR

To help students in planning their courses of study and for general advice on the academic programme, the HoD shall allot twenty students to a faculty who will function as faculty mentor throughout their period of study. Faculty mentor shall advise the students and monitor their behavior and academic performance. Problems if any shall be counseled by them periodically. The Faculty mentor is also responsible to inform the parents of their wards' progress. Faculty mentor shall display the cumulative attendance particulars of his / her ward students' periodically (once in 2 weeks) on the Notice Board to enable the students, know their attendance status and satisfy the **clause 7** of this regulation.

b. ONLINE COURSE COORDINATOR

To help students in planning their online courses and for general advice on online courses, the HOD shall nominate a coordinator for the online courses. The Online course coordinator shall identify the courses which students can select for their programme from the available online courses offered by the different agencies periodically and inform the same to the students. Further, the coordinators shall advice the students regarding the online courses and monitor their course.

9. CLASS COMMITTEE

Every class shall have a Class Committee consisting of the faculty members of the various courses of the class concerned, student representatives (Minimum 2 boys and 2 girls of various capabilities and Maximum of 6 members) and the concerned HoD / senior faculty as Chairperson. The objective of the Class Committee Meeting is all about the teaching – learning process. Class Committee shall be convened at least once in a month. The functions of the Class Committee shall include

- Analysing and solving problems experienced by students in the class room and in the laboratories.
- Analyzing the performance of the students of the class after each test and finding the ways and means to improve the performance.
- The Class Committee of a particular class of any department is normally constituted by the HoD / Chairperson of the Class Committee. However, if the students of different departments are mixed in a class, the Class Committee shall be constituted by the respective Dean of the Faculty.
- The class committee shall be constituted during the first week of each semester.
- The HoD / Chairperson of the Class committee is authorized to convene the meeting of the class committee.
- The respective Dean of the Faculty has the right to participate in any Class committee meeting.

- The Chairperson is required to prepare the minutes of every meeting, and submit the same to Dean concerned within two days after having convened the meeting. Serious issues if any shall be brought to the notice of the Registrar by the HoD / Chairperson immediately.

10. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or department shall have a "Course Committee" comprising all the teachers handling the common course with one of them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the respective Dean depending upon whether all the teachers handling the common course belong to a single department or to various other departments. The 'Course Committee' shall meet in order to arrive at a common scheme of evaluation for the tests to ensure a uniform evaluation of the tests. If feasible, the course committee shall prepare a common question paper for the Internal Assessment test(s). Course Committee Meeting is conducted once in a semester.

11. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

11.1 **Attendance and assessment:** Every Faculty is required to maintain an **Attendance and Assessment Record (Log book)** which consists of attendance of students marked for each lecture / practical / project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the HoD once in a fortnight for checking the syllabus coverage and the records of test marks and attendance. The HoD shall sign with date after due verification. The same shall be submitted to respective Dean once in a month. After the completion of the semester the HoD should keep this record in safe custody for five years. Because records of attendance and assessment shall be submitted for Inspection as and when required by the KAHE / any other approved body.

11.2 **Continuous Internal Assessment (CIA)**: The performance of students in each course will be continuously assessed by the respective faculty as per the guidelines given below:

Theory Courses

S. No.	Category	Maximum Marks
1.	Assignment*	5
2.	Attendance	5
3	Seminar	5
4.	Test – I (1 ½ units- Unit I and II)	8
5	Test – II (1 ½ units Unit II and III)	8
6	Test III (2 units Unit IV and V)	9

Continuous Internal Assessment : Total	40

* Two Assignments (Assignment I before Internal Test – I and assignment II before Internal Test – II).

Practical Courses

S. No.	Category	Maximum Marks
1.	Attendance	5
2.	Observation work	5
3.	Record work	5
4.	Model Examination	20
5.	*Viva – voce* [Comprehensive]*	5
Continuous Internal Assessment: Total		**40**

* Includes *Viva- voce* conducted during the model Exam practical.

Every practical Exercise / Experiment shall be evaluated based on the conduct of Exercise/ Experiment and records maintained.

11.3 Pattern of Test Question Paper

Portions for Internal Test – I : First 1 ½ Units(Unit I and II)

Portions for Internal Test – II : Second 1 ½ Units (Unit II and III)

Portions for Internal Test – III : Two units (Unit IV and V)

Instruction	Remarks
Maximum Marks	50 marks
Duration	2 Hours
Part – A	Objective type (20x1=20)
Part - B	Short Answer Type (3 x 2 = 6)
Part - C	3 Eight mark questions ‘either – or’ choice (3 x 8 = 24 Marks)

11.4 Attendance

Marks Distribution for Attendance

S. No.	Attendance (%)	Maximum Marks
1	91 and above	5.0
2	81 - 90	4.0
3	76 - 80	3.0
4	Less than 75	0

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12. ESE EXAMINATIONS

12.1 End Semester Examination (ESE): End Semester Examination will be held at the end of each semester for each course. The question paper is for a maximum 60 marks.

Pattern of ESE Question Paper:

Instruction	Remarks
Maximum Marks	60 marks for ESE.
Duration	3 hours (½ Hr for Part – A Online & 2 ½ Hours for Part – B and C
Part - A	20 Questions of 1 mark each (20 x 1 = 20 Marks) Question No. 1 to 20 Online Multiple Choice Questions
Part- B	5 Questions of 2 marks each(5 x 2 = 10 Marks) Covering all the five units of the syllabus Question No. 21 to 25
Part- C	5 six marks Questions of 6 marks each (5 x 6 = 30 Marks.) Question No. 26 to 30 will be 'either-or' type, covering all five units of the syllabus; i.e., Question No. 26: Unit - I, either 26 (a) or 26 (b), Question No. 27: Unit - II, either 27 (a) or 27 (b), Question No. 28: Unit - III, either 28 (a) or 28 (b), Question No. 29: Unit - IV, either 29 (a) or 29 (b), Question No. 30: Unit - V, either 30 (a) or 30 (b)

12.2 **Practical:** There shall be combined valuation. The pattern of distribution of marks shall be as given below.

Experiments : 40 Marks

Record	: 10 Marks
Viva-voce	: 10 Marks
Total	**: 60 Marks**

Record Notebooks for Practical Examination

Candidate taking the practical examination should submit Bonafide Record Notebook prescribed for the practical examination; failing which the candidate will not be permitted to take the practical examination.

In case of failures in Practical Examination, the marks awarded for the Record at the time of first appearance of the Practical Examination shall remain the same at the subsequent appearance also by the candidate.

12.3. **Evaluation of Project Work**

12.3.1 The project work shall carry a maximum of 100 marks. (CIA - 40 and ESE – 60*)

*Combined valuation of Internal and External Examiners.

12.3.2 The project report prepared according to the approved guidelines and duly signed by the supervisor(s) shall be submitted to HoD.

12.3.3 The evaluation of the project will be based on the project report submitted and a *viva-voce* Examination by a team consisting of the supervisor, who will be the Internal Examiner and an External Examiner who shall be appointed by the COE. In case the guide is not available, the HoD shall act as an Internal Examiner for the same.

12.3.4 If a candidate fails to submit the project report on or before the specified date given by the Examination Section, the candidate is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.

If a candidate fails in the respective viva-voce examinations he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. For this purpose the same Internal and External examiner shall evaluate the resubmitted report.

12.3.5 Copy of the approved project report after the successful completion of *viva-voce* examination shall be kept in the KAHE library.

13. PASSING REQUIREMENTS

13.1 Passing minimum: There is a passing minimum 20 marks out of 40 marks for CIA and the passing minimum is 30 marks out of 60 marks in ESE. The overall passing in each course is 50 out of 100 marks (Sum of the marks in CIA and ESE examination).

13.2 If a candidate fails to secure a pass in a particular course (either CIA or ESE or Both) as per clause 13.1, it is mandatory that the candidate has to register and reappear for the examination in that course during the subsequent semester when examination is conducted for the same till he / she receives a pass both in CIA and ESE (vide Clause 2.1).

13.3 Candidate failed in CIA will be permitted to improve CIA marks in the subsequent semesters by writing tests and by re-submitting Assignments.

13.4 CIA marks (if it is pass) obtained by the candidate in the first appearance shall be retained by the Office of the Controller of Examinations and considered valid for all subsequent attempts till the candidate secures a pass in ESE

13.5 Candidate who is absent in ESE in a Course / Practical / Project Work after having enrolled for the same shall be considered to have **failed** in that examination.

14. IMPROVEMENT OF MARKS IN THE COURSES ALREADY PASSED

Candidates desirous to improve the marks secured in a passed course in their first attempt shall reappear once (**only in ESE**) in the subsequent semester. **The improved marks shall be considered for classification but not for ranking.** If there is no improvement there shall be no change in the marks awarded earlier.

15. AWARD OF LETTER GRADES

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

Letter grade	Marks Range	Grade Point	Description
O	91 - 100	10	OUTSTANDING
A+	81- 90	9	EXCELLENT
A	71-80	8	VERY GOOD
B+	66- 70	7	GOOD
B	61 – 65	6	ABOVE AVERAGE
C	55 - 60	5	AVERAGE
D	50 - 54	4	PASS
RA	<50	-	REAPPEARANCE
AAA	-	-	ABSENT

16. GRADE SHEET

After the declaration of the results, Grade Sheets will be issued to each student which will contain the following details:

i. The list of courses enrolled during the semester and the grade scored.

ii. The Grade Point Average (**GPA**) for the semester and

iii. The Cumulative Grade Point Average (**CGPA**) of all courses enrolled from first semester onwards.

iv. Remark on Extension Activities (only in the 6th Semester Grade Sheet)

GPA of a Semester and CGPA of a programme will be calculated as follows.

GPA of a Semester = (Sum of the product of the GP by the corresponding credits of the courses offered in that Semester) / (Sum of the credits of the courses of that Semester)

i.e. **GPA** of a Semester = $\frac{\sum_i CiGPi}{\sum_i Ci}$

CGPA of the entire programme = (Sum of the product of the GPs by the corresponding credits of the courses offered for the entire programme) / (Sum of the credits of the courses of the entire programme)

i.e. **CGPA** of the entire programme = $\frac{\sum_n \sum_i CniGPni}{\sum_n \sum_i Cni}$

where,

Ci is the credit fixed for the course 'i' in any semester

GPi is the grade point obtained for the course 'i' in any semester

'n' refers to the Semester in which such courses are credited.

Note: RA grade will be excluded for calculating **GPA** and **CGPA**.

17. REVALUATION

A candidate can apply for revaluation and re-totaling of his / her semester examination answer script (**theory courses only**), within 2 weeks from the date of declaration of results, on payment of a prescribed fee. For the same, the prescribed application has to be sent to the Controller of Examinations through the HoD. **A candidate can apply for revaluation of answer scripts not exceeding 5 courses at a time.** The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate through the HoD concerned**.** Revaluation is not permitted for supplementary theory courses.

18. TRANSPARENCY AND GRIEVANCE COMMITTEE

Revaluation and Re-totaling is allowed on representation (clause 17). Student may get the Xerox copy of the answer script on payment of prescribed fee, if he / she wishes. The student may represent the grievance, if any, to the Grievance Committee, which consists of Dean of the Faculty, (if Dean is HoD, the Dean of another Faculty nominated by the KAHE), The HoD of Department concerned, the faculty of the course and Dean from other discipline nominated by the KAHE and the CoE. If the Committee feels that the grievance is genuine, the script may be sent for external valuation; the marks awarded by the External examiner will be final. The student has to pay the prescribed fee for the same.

19. ELIGIBILITY FOR THE AWARD OF THE DEGREE

A student shall be declared to be eligible for the conferment of the Degree if he / she has

- Successfully completed all the components prescribed under Part I to Part IV in the CBCS pattern to earn the minimum required credits as specified in the curriculum corresponding to his / her programme within the stipulated period vide class 2.1.
- Not any disciplinary action pending against him / her.
- The award of the degree must be approved by the Board of Management.

20. CLASSIFICATION OF THE DEGREE AWARDED

20.1 Candidate who qualifies for the award of the Degree (vide clause 19) having passed the examination in all the courses in his / her first appearance, within the specified minimum number of semesters and securing a **CGPA not less than 8** shall be declared to have passed the examination in the **First Class with Distinction.**

20.2 Candidate who qualifies for the award of the Degree (vide clause 19) having passed the examination in all the courses within the specified maximum number of semesters (vide clause 2.1), securing a **CGPA not less than 6.5** shall be declared to have passed the examination in the **First Class**.

20.3 All other candidates (not covered in clauses 20.1 and 20.2) who qualify for the award of the degree (vide Clause 19) shall be declared to have passed the examination in the **Second Class**.

21. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

21.1 Candidate due to valid reasons and on prior application, be granted permission to withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.

21.2 Such withdrawal shall be permitted only once during the entire period of study of the degree programme.

21.3 Withdrawal of application is valid only if it is made within 10 days prior to the commencement of the examination in that course or courses and recommended by the HoD / Dean concerned and approved by the Registrar.

21.3.1 Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

21.4 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction. This provision is not applicable to those who seek withdrawal during **VI semester**.

21.5 Withdrawal from the End semester examination is **NOT** applicable to arrears courses of previous semesters.

21.6 The candidate shall reappear for the withdrawn courses during the examination conducted in the subsequent semester.

22. PROVISION FOR AUTHORISED BREAK OF STUDY

22.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme**.** However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the Registrar, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of

the Department stating the reasons therefore and the probable date of rejoining the programme.

22.2 The candidate thus permitted to rejoin the Programme after the break shall be governed by the Curriculum and Regulations in force at the time of rejoining. Such candidates may have to do additional courses as per the Regulations in force at that period of time.

22.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification. (Vide Clause 20). However, additional break of study granted will be counted for the purpose of classification.

22.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 2.1 irrespective of the period of break of study (vide clause 22.1) in order that he/she may be eligible for the award of the degree.

22.5 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Break of Study' or 'Withdrawal' (Clause 21 and 22) is not applicable for this case.

23. RANKING

A candidate who qualifies for the UG Degree programme passing all the Examinations in the first attempt, within the minimum period prescribed for the programme of study from Semester I through Semester VI to the programme shall be eligible for ranking. Such ranking will be confined to 10% of the total number of candidates qualified in that particular programme of study subject to a maximum of 10 ranks.

24. SUPPLEMENTARY EXAMINATION

Supplementary Examination will be conducted only for the final semester students within ten days from the date of publication of results for students who have failed in one theory course only. Such students shall apply with prescribed fee to the Controller of Examinations within the stipulated time.

25. DISCIPLINE

25.1. If a student indulges in malpractice in any of the Internal / External Examinations he / she shall be liable for punitive action as prescribed by the KAHE from time to time.

25.2. Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the KAHE. The erring students will be referred to the disciplinary committee constituted by the KAHE, to enquire into acts of indiscipline and recommend the disciplinary action to be taken.

26. REVISION OF REGULATION AND CURRICULUM

Karpagam Academy of Higher Education may from time to time revise, amend or change the Regulations, Scheme of Examinations and syllabi if found necessary.

Annexure I

S.No	Programme	Subject	Eligibility
1	B. Sc.	Biochemistry	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Biology or Botany or Zoology or chemistry as subjects at the Higher Secondary level.
2	B. Sc.	Biotechnology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Biology or Botany or Zoology as subjects at the Higher Secondary level.
3	B. Sc.	Computer Science	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3-year diploma after 10^{th} or 10+2 pattern of education taking computer science/maths as one of the subject.
4	B.Sc.	Mathematics	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Mathematics /statistics as subjects at the Higher Secondary level. (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking maths as one of the subject.
5	B.Sc.	Physics	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Physics as one of the subjects at the Higher Secondary level (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking physics as one of the subject.
6	B. Sc.	Chemistry	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Chemistry as one of the subjects at the Higher Secondary level.
7	B. Sc.	Microbiology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Biology or Botany or Zoology as subjects at the Higher Secondary level.

8	B. Sc.	Information Technology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking computer science/maths as one of the subject.
9	B. Sc.	Computer Technology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking computer science/maths as one of the subject.
10	B.Sc.	Computer Science (Cognitive Systems)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3-year diploma after 10^{th} or 10+2 pattern of education taking computer science/maths as one of the subject.
11	B.Sc.	Computer Science (Artificial Intelligence and Data Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking computer science/maths as one of the subject.
12	BCA	Computer Application	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
13	B.Sc.	Applied Science (Material Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Physics as one of the subjects at the Higher Secondary level (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking the respective subject as one of the subject.
14	B.Sc.	Applied Science (Foundary Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or

			Board under the 10+2 pattern taking Physics as one of the subjects at the Higher Secondary level (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking the respective subject as one of the subject.
15	B. Com.	Commerce	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
16	B.Com (CA)	Commerce with Computer Applications	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern.
17	B. Com. (PA)	Commerce with Professional Accounting	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
18	B. Com. (BPS)	Commerce with Business Process Services	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
19	B.B.A.	Business Administration	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
20	B. Com	Financial Analytics	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
21	B. Com	International Accounting and Finance	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .

DEPARTMENT OF CHEMISTRY
FACULTY OF ARTS, SCIENCE AND HUMANITIES

UG PROGRAM (CBCS) – B.Sc. Chemistry
(2021–2022 Batch and onwards)

Course code	Name of the course	Course nature	Objectives & Outcomes		Instruction hours per week			Credits	Maximum Marks			Page No.
			PEO's	PO's	L	T	P		CIA	ESE	Total	
SEMESTER I												
21LSU101	Language I	AEC	6	1,2,3, 10,9	4	0	0	4	40	60	100	33
21ENU101	English I	AEC	6	1,2,3, 10,9	4	0	0	4	40	60	100	36
21CHU101	Mathematics I	Allied	2,4	1,6,5	4	0	0	4	40	60	100	37
21CHU102	Inorganic Chemistry I:Atomic structure and Chemical Bonding	CC	1,3,5 ,7	1,3,6, 7,8	5	0	0	5	40	60	100	39
21CHU103	Organic Chemistry I: Basics and Hydrocarbons	CC	1,3,5 ,7	1,3,6, 7,8	5	0	0	5	40	60	100	41
21CHU111	Mathematics Practical I	Allied	2,4	1,6,5	0	0	4	2	40	60	100	43
21CHU112	Atomic Structure and Chemical Bonding- Practical	CC	1,3,5 ,7	1,3,6, 7,8	0	0	2	1	40	60	100	44
21CHU113	Basics and Hydrocarbons- Practical	CC	1,3,5 ,7	1,3,6, 7,8	0	0	2	1	40	60	100	45
	Semester Total				22	0	8	**26**	**320**	**480**	**800**	
SEMESTER II												
21LSU201	Language II	AEC	6	1,2,3, 10,9	4	0	0	4	40	60	100	47
21ENU201	English II	AEC	6	1,2,3, 10,9	4	0	0	4	40	60	100	50
21CHU201	Mathematics II	Allied	2,4	1,6,5	4	0	0	4	40	60	100	51
21CHU202	Physical Chemistry I: Chemical Thermodynamics and its Application	CC	1,3,5 ,7	1,3,6, 7,8	5	0	0	4	40	60	100	53
21CHU203	Organic Chemistry II: Oxygen Containing Functional Groups	CC	1,3,5 ,7	1,3,6, 7,8	6	0	0	5	40	60	100	55
21CHU211	Chemical Thermodynamics and its Application- Practical	CC	1,3,5 ,7	1,3,6, 7,8	0	0	2	1	40	60	100	57
21CHU212	Oxygen Containing Functional Groups-Practical	CC	1,3,5 ,7	1,3,6, 7,8	0	0	2	1	40	60	100	58
21AEC201	Environmental Studies	AEC	6,1	1,2,3, 10,9	3	0	0	3	40	60	100	60
	Internship	-	-	-	-	-	-	-	-	-	-	
	Semester Total				26	0	4	**26**	**320**	**480**	**800**	
SEMESTER III												
21CHU301	Physics I	Allied	2,4	1,6,5	04	0	0	4	40	60	100	63
21CHU302	Inorganic Chemistry II: Coordination Chemistry	CC	1,3,5 ,7	1,3,6, 7,8	04	0	0	4	40	60	100	65
21CHU303	Physical Chemistry II: Phase Equilibrium and Chemical Kinetics	CC	1,3,5 ,7	1,3,6, 7,8	04	0	0	4	40	60	100	67
21CHU311	Physics Practical-I	Allied	2,4	1,6,5	0	0	4	2	40	60	100	69
21CHU312	Coordination Chemistry- Practical	CC	1,3,5 ,7	1,3,6, 7,8	0	0	4	2	40	60	100	70
21CHU313	Phase Equilibrium and Chemical Kinetics- Practical	CC	1,3,5 ,7	1,3,6, 7,8	0	0	4	2	40	60	100	71
21CHU304A	Pharmaceutical Chemistry	SEC	2,4	1,6,1	03	0	0	3	40	60	100	73

21CHU304B	Herbal Technology and Renewable Resources	SEC		0,9								75
21CHU314A	Pharmaceutical Chemistry- Practical	SEC	2,4	1,6,10,9	0	0	3	1	40	60	100	77
21CHU314B	Herbal Technology and Renewable Resources-Practical	SEC										78
	Semester Total				15	0	15	**22**	**320**	**480**	**800**	
SEMESTER IV												
21CHU401	Physics II	Allied	2,4	1,6,5	04	0	0	4	40	60	100	79
21CHU402	Physical Chemistry III: Electrochemistry	CC	1,3,5,7	1,3,6,7,8	04	0	0	4	40	60	100	81
21CHU403	Organic Chemistry III : Organic Spectroscopy	CC	1,3,5,7	1,3,6,7,8	04	0	0	4	40	60	100	83
21CHU411	Physics Practical-II	Allied	2,4	1,6,5	0	0	4	2	40	60	100	85
21CHU412	Electrochemistry- Practical	CC	1,3,5,7	1,3,6,7,8	0	0	4	2	40	60	100	86
21CHU413	Organic Spectroscopy- Practical	CC	1,3,5,7	1,3,6,7,8	0	0	4	2	40	60	100	88
21CHU404A	Green Methods in Chemistry	SEC	2,4	1,6,10,9	03	0	0	3	40	60	100	89
21CHU404B	Analytical Clinical Biochemistry	SEC	2,4	1,6,10,9								91
21CHU414A	Green Methods in Chemistry- Practical	SEC	2,4	1,6,10,9	0	0	3	1	40	60	100	93
21CHU414B	Analytical Clinical Biochemistry-Practical	SEC	2,4	1,6,10,9								94
	Internship	-	-	-	-	-	-	-	-	-	-	
	Semester Total				15	0	15	**22**	**320**	**480**	**800**	
SEMESTER V												
21CHU501A	Cheminformatics	SEC	2,4	1,6,10,9	03	0	0	3	40	60	100	95
21CHU501B	Cosmetics and Healthcare Products	SEC	2,4									97
21CHU511A	Cheminformatics- Practical	SEC	2,4	1,6,10,9	0	0	3	1	40	60	100	98
21CHU511B	Cosmetics and Healthcare Products Practical	SEC	2,4									99
21CHU502A	Polymer Chemistry	DSE	1,3,5,7	1,5,6,7	04	0	0	4	40	60	100	100
21CHU502B	Novel Inorganic Solids	DSE	1,3,5,7	1,5,6,7								102
21CHU503	Organic Chemistry IV: Nitrogen Containing Functional Groups, Heterocyclic Chemistry and Natural Products	CC	1,3,5,7	1,3,6,7,8	04	0	0	4	40	60	100	104
21CHU504	Inorganic Chemistry III: Metallurgy, s- block and p-block Elements	CC	1,3,5,7	1,3,6,7,8	04	0	0	4	40	60	100	106
21CHU512A	Polymer Chemistry- Practical	DSE	1,3,5,7	1,5,6,7	0	0	4	2	40	60	100	108
21CHU512B	Novel Inorganic Solids- Practical	DSE	1,3,5,7	1,5,6,7								110
21CHU513	Nitrogen Containing Functional Groups, Heterocyclic Chemistry and Natural Products – Practical	CC	1,3,5,7	1,3,6,7,8	0	0	04	2	40	60	100	111
21CHU514	Metallurgy, s- block and p-block Elements - Practical	CC	1,3,5,7	1,3,6,7,8	0	0	04	2	40	60	100	112
	Semester Total				15	0	15	**22**	**320**	**480**	**800**	
SEMESTER VI												
21CHU601A	Analytical Chemistry	SEC	2,4	1,6,10,9	03	0	0	3	40	60	100	113
21CHU601B	Pesticide, Insecticide and Herbicide	SEC	2,4									115

	Chemistry											
21CHU611A	Analytical Chemistry-Practical	SEC	2,4	1,6,10,9	0	0	3	1	40	60	100	117
21CHU611B	Pesticide, Insecticide and Herbicide Chemistry - Practical	SEC	2,4									119
21CHU602	Inorganic Chemistry IV: Organometallic Chemistry	CC	1,3,5,7	1,3,6,7,8	04	0	0	4	40	60	100	120
21CHU603	Physical Chemistry IV: States of Matter and Ionic Equilibrium	CC	1,3,5,7	1,3,6,7,8	04	0	0	4	40	60	100	122
21CHU612	Organometallic Chemistry- Practical	CC	1,3,5,7	1,3,6,7,8	0	0	04	2	40	60	100	124
21CHU613	States of Matter and Ionic Equilibrium-Practical	CC	1,3,5,7	1,3,6,7,8	0	0	04	2	40	60	100	125
21CHU691	Project Work	CC	1,3,5	1,3,6,7,8	0	0	08	06	40	60	100	127
	Semester Total				11	0	19	**22**	**280**	**420**	**700**	
ECA / NCC / NSS / Sports / General interest /etc											Good	
	G. Total				104	0	76	**140**	**1880**	**2820**	**4700**	

Ability Enhancement Courses (AEC)			
Semester	**Elective**	**Course Code**	**Name of the Course**
I	AEC-1	21LSU101	Language –I
	AEC-2	21ENU101	English I
II	AEC-3	21LSU201	Language –II
	AEC-4	21ENU202	English II
	AEC-5	21AEC201	Environmental Studies

Allied Courses		
Semester	**Course Code**	**Name of the Course**
I	21CHU101	Mathematics I
	21CHU111	Mathematics Practical-I
II	21CHU201	Mathematics II
III	21CHU301	Physics I
	21CHU311	Physics Practical-I
IV	21CHU401	Physics II
	21CHU411	Physics Practical- II

Core Courses			
Semester		**Course Code**	**Name of the Course**
I	CC-1	21CHU102	Inorganic Chemistry I:Atomic structure and Chemical Bonding
		21CHU112	Atomic structure and Chemical Bonding-Practical
	CC-2	21CHU103	Organic Chemistry I: Basics and Hydrocarbons
		21CHU113	Basics and Hydrocarbons-Practical
II	CC-3	21CHU202	Physical Chemistry I:Chemical Thermodynamics and its Application
		21CHU211	Chemical Thermodynamics and its Application- Practical
	CC-4	21CHU203	Organic Chemistry practical II: Oxygen Containing Functional Groups
		21CHU212	Oxygen Containing Functional Groups- Practical

III	CC-5	21CHU302	Inorganic Chemistry II: Coordination Chemistry
		21CHU312	Coordination Chemistry- Practical
	CC-6	21CHU303	Physical Chemistry II: Phase Equilibrium and Chemical Kinetics
		21CHU313	Phase Equilibrium and Chemical Kinetics- Practical
IV	CC-7	21CHU402	Physical Chemistry III: Electrochemistry
		21CHU412	Electrochemistry- Practical
	CC-8	21CHU403	Organic Chemistry: Organic Spectroscopy
		21CHU413	Organic Spectroscopy- Practical
V	CC-9	21CHU503	Organic Chemistry IV: Nitrogen Containing Functional Groups, Heterocyclic Chemistry and Natural Products
		21CHU513	Nitrogen Containing Functional Groups, Heterocyclic Chemistry and Natural Products- Practical
	CC-10	21CHU504	Inorganic Chemistry III: Metallurgy, s- block and p-block Elements
		21CHU514	Metallurgy, s- block and p-block Elements - Practical
VI	CC-11	21CHU602	Inorganic Chemistry IV: Organometallic Chemistry
		21CHU612	Organometallic Chemistry- Practical
	CC-12	21CHU603	Physical Chemistry IV: States of Matter and Ionic Equilibrium
		21CHU613	States of Matter and Ionic Equilibrium- Practical
	CC-13	21CHU691	Project and Viva-voce

Skill Enhancement Elective Courses			
Semester		**Course Code**	**Name of the Course**
III	SEC-1	21CHU304A	Pharmaceutical Chemistry
		21CHU314A	Pharmaceutical Chemistry - Practical
	SEC-2	21CHU304B	Herbal Technology and Renewable Resources
		21CHU314B	Herbal Technology and Renewable Resources - Practical
IV	SEC-3	21CHU404A	Green Methods in Chemistry
		21CHU414A	Green Methods in Chemistry –Practi cal
	SEC-4	21CHU404B	Analytical Clinical Biochemistry
		21CHU414B	Analytical Clinical Biochemistry - Practical
V	SEC-5	21CHU501A	Cheminformatics
		21CHU511A	Cheminformatics - Practical
	SEC-6	21CHU501B	Cosmetics and Healthcare Products
		21CHU511B	Cosmetics and Healthcare Products - Practical
VI	SEC-7	21CHU601A	Analytical Chemistry
		21CHU611A	Analytical Chemistry - Practical
	SEC-8	21CHU601B	Pesticide, Insecticide and Herbicide Chemistry
		21CHU611B	Pesticide, Insecticide and Herbicide Chemistry-Practical

Discipline Specific Elective			
Semester		**Course Code**	**Name of the Course**
VI	DSE-1	21CHU502A	Polymer Chemistry
		21CHU512A	Polymer Chemistry - Practical
VI	DSE-2	21CHU502B	Novel Inorganic Solids
		21CHU512B	Novel Inorganic Solids- Practical

Curriculum is the heart of any educational system. It can be focused either to achieve the objectives of each course of the programme or on the expected outcomes from each course. Chemistry is referred to as the science that systematically studies the composition, properties, and reactivity of matter at atomic and molecular level. The scope of chemistry is very broad. The key areas of study of chemistry comprise Organic chemistry, Inorganic Chemistry, Physical Chemistry and Analytical Chemistry. Organic chemistry deals with study of substances containing carbon mostly; inorganic chemistry deals with study of all other elements/compounds/substances and their chemical properties. Physical chemistry deals with applications of concepts, laws to chemical phenomena. Analytical chemistry, in general, deals with identification and quantification of materials. Development of new interdisciplinary subjects like nano-materials, biomaterials, etc. and their applications from chemistry point of view added new dimension to materials chemistry. Thus, the degree programme in chemistry also intended to cover overlapping areas of chemistry with physics, biology, environmental sciences. Further, a broad range of subjects such as materials chemistry, biomaterials, nanomaterials, environmental chemistry, etc., has also been introduced which can be helpful for students/faculty members to broaden the scope of their studies and hence applications from job prospective point of view. Therefore, as a part of efforts to enhance employability of graduates of chemistry, the curricula also include learning experience with industries and research laboratories as interns. In addition, industrial visits/industrial projects are encouraged and added to the curriculum in order to enhance better exposure to jobs/employment opportunities in industries, scientific projects and alliedsectors.

This modified syllabus has been made to enable the students to equip for national level competitive exams that they may attempt in future. To ensure implementation of a holistic pedagogical model, several allied disciplines are covered/introduced in this framework, including Physics, Mathematics, Biology and a number of generic, and ability enhancement electives. In addition, employability of B.Sc. Chemistry graduate is given due importance such that their core competency in the subject matter, both theoretical and practical, is ensured. To expand the employability of graduates, a number of skill development courses are also introduced.

Objectives of Bachelor's degree programme in Chemistry

The aim of bachelor's degree programme in chemistry is intended to provide:

1. Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories.
2. To develop students' ability and skill to acquire expertise over solving both theoretical and applied chemistry problems.
3. To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self employment/entrepreneurship.
4. To provide an environment that ensures cognitive development of students in a holistic manner. A complete dialogue about chemistry, chemical equations and its significance is fostered in this framework, rather than mere theoretical aspects.

5. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A chemistry graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
6. To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
7. To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

Program Outcomes

The student graduating with the Degree B.Sc., Chemistry should be able to acquire

1. **Core competency**: Students will acquire core competency in the subject Chemistry, and in allied subject areas.

i. Systematic and coherent understanding of the fundamental concepts in Physical chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry and all other related allied chemistry subjects.
ii. Students will be able to use the evidence based comparative chemistry approach to explain the chemical synthesis and analysis.
iii. The students will be able to understand the characterization of materials.
iv. Students will be able to understand the basic principle of equipment's, instruments used in the chemistry laboratory.
v. Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Chemistry.

2. Disciplinary knowledge and skill (Additional Academic Knowledge):

A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied chemistry knowledge in various fields of interest like Analytical Chemistry, Physical Chemistry, Inorganic Chemistry, Organic Chemistry, Material Chemistry, etc. Further, the student will be capable of using of advanced instruments and related soft-wares for in-depth characterization of materials/chemical analysis and separation technology.

3. Skilled communicator:

The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

4. Critical thinker and problem solver:

The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic chemistry knowledge and concepts.

5. Sense of inquiry:

It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.

6. Team player:

The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based situation and industry.

7. Skilled project manager:

The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

8. Digitally literate:

The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, and use of chemical simulation software and related computational work.

9. Ethical awareness/reasoning:

A graduate student requires understanding and developing ethical awareness/reasoning which the course curriculum adequately provides.

10. Life long learner:

The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

The core courses would fortify the students with in-depth subject knowledge concurrently; the discipline specific electives will add additional knowledge about applied aspects of the program as well as its applicability in both academia and industry. Generic electives will introduce integration among various interdisciplinary courses. The skill enhancement courses would further add additional skills related to the subject as well as other than subject. In brief the student graduated with this type of curriculum would be able to disseminate subject knowledge along with necessary skills to suffice their capabilities for academia, entrepreneurship and Industry.

Attributes of a Chemistry Graduate

Attributes of chemistry graduate under the outcome-based teaching-learning framework may encompass the following:

1. **Core competency**: The chemistry graduates are expected to know the fundamental concepts of chemistry and applied chemistry. These fundamental concepts would reflect the latest understanding of the field, and therefore, are dynamic in nature and require frequent and time-bound revisions.

2. **Communication skills**: Chemistry graduates are expected to possess minimum standards of communication skills expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/finding/concepts to wider audience

3. **Critical thinking**: Chemistry graduates are expected to know basics of cognitive biases, mental models, logical fallacies, scientific methodology and constructing cogent scientific arguments.

4. **Psychological skills**: Graduates are expected to possess basic psychological skills required to face the world at large, as well as the skills to deal with individuals and students of various sociocultural, economic and educational levels. Psychological skills may include feedback loops, self-compassion, self-reflection, goal-setting, interpersonal relationships, and emotional management.

5. **Problem-solving**: Graduates are expected to be equipped with problem-solving philosophical approaches that are pertinent across the disciplines;

6. **Analytical reasoning**: Graduates are expected to acquire formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc.

7. **Research-skills**: Graduates are expected to be keenly observant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment through statistical hypothesis testing and other a priori reasoning including logical deduction.

8. **Teamwork**: Graduates are expected to be team players, with productive cooperations involving members from diverse socio-cultural backgrounds.

9. **Digital Literacy**: Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital tools for lifelong learning. Graduates should be able to spot data fabrication and fake news by applying rational scepticism and analytical reasoning.

10. **Moral and ethical awareness**: Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and soon.

11. **Leadership readiness**: Graduates are expected to be familiar with decision making process and basic managerial skills to become a better leader. Skills may include defining objective vision and mission, how to become charismatic inspiring leader and soon.

Mapping of the courses

Core Courses

S.No.	Programme Outcome	CC-1	CC-2	CC-3	CC-4	CC-5	CC-6	CC-7	CC-8	CC-9	CC-10	CC-11	CC-12	CC-13
1	Core competency	√	√	√	√	√	√	√	√	√	√	√	√	√
2	Critical thinking	√	√	√	√	√	√	√	√	√	√	√	√	√
3	Analytical reasoning	√	√	√	√	√	√	√	√	√	√	√	√	√
4	Research-skills	√	√	√	√	√	√	√	√	√	√	√	√	√
5	Team work	√	√	√	√	√	√	√	√	√	√	√	√	√

Discipline Specific Electives

S.No.	Programme Outcome	DSE-1	DSE-2	DSE-3
1	Additional Academic knowledge	√	√	√
2	Problem Solving	√	√	√
3	Analytical skills	√	√	√
4	Research Skills	√	√	√

Skill Enhancement Courses

S.No.	Programme Outcome	SEC-1	SEC-2	SEC-3	SEC-4	SEC-5	SEC-6	SEC-7	SEC-8
1	Additional Knowledge Enhancement	√	√	√	√	√	√	√	√
2	Exposure Beyond Discipline	√	√	√	√	√	√	√	√
3	Analytical reasoning	√	√	√	√	√	√	√	√
4	Moral and Ethical Awareness	√	√	√	√	√	√	√	√
5	Digital literacy	√	√	√	√	√	√	√	√

Generic Elective Courses

S.No.	Programme Outcome	SEC-1	SEC-2	SEC-3	SEC-4	SEC-5	SEC-6	SEC-7	SEC-8
1	Additional Knowledge Enhancement	√	√	√	√	√	√	√	√
2	Exposure Beyond Discipline	√	√	√	√	√	√	√	√
3	Analytical reasoning	√	√	√	√	√	√	√	√
4	Moral and Ethical Awareness	√	√	√	√	√	√	√	√
5	Digital literacy	√	√	√	√	√	√	√	√

Generic Elective Courses

S.No	Programme Outcome	GEC-1	GEC-2	GEC-3	GEC-4
1	Additional Knowledge Enhancement	√	√	√	√
2	Exposure Beyond Discipline	√	√	√	√
3	Analytical reasoning	√	√	√	√
4	Problem solving	√	√	√	√

Ability Enhancement Courses

S.No	Programme Outcome	AEC-1	AEC-2	AEC-3	AEC-4
1	Additional Knowledge Enhancement	√	√	√	√
2	Communication	√	√	√	√
3	Moral and ethical awareness	√	√	√	√
4	Leadership readiness	√	√	√	√
5	Psychological skills	√	√	√	√

Mapping between PEO's and PO's

PEO/PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	√	√		√	√		√	√	√	√
B			√	√	√		√			
C		√		√		√	√		√	
D	√	√		√		√		√	√	√
E			√		√		√	√		
F		√		√		√		√		√
G	√		√				√	√		√
H		√		√		√			√	

முதல்பருவம்

21LSU101 **பகுதி – I தமிழ், தாள் 1** **4H 4C**

கற்பிக்கும்நேரம்/வாரம்: 4 **மணி** **மதிப்பெண்: அகமதிப்பீடு /**
எழுத்துத்தேர்வு: 40 / 60

தேர்வு நேரம்: 3

மணிநேரம்

பாடத்திட்டப்பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும்மேம்படுத்துதல்.
- ஆய்வுநோக்கைமேம்படுத்துதல்.
- இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.
- மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.
- வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.

பாடத்திட்டப்பயன்விளைவு

1. இந்தியகுடியுரிமைப்பணிமுதலானபோட்டித்தேர்வுகளில், விருப்பப்பாடமாகஇடம்பெறுகின்ற, 'தமிழ்இலக்கியவரலாறு' குறித்தமுழுமையானஅறிமுகம்பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல்மற்றும்தொல்லியல்சார்ந்தஆவணத்தேடலுக்குரியஆய்வுமனப்பான்மையுடன், இலக்கியங்களைஅணுகுதல்.
3. தமிழின்வளர்ச்சித்துறையாகிய, 'அறிவியல்தமிழ்' ; 'இணையதமிழ்' குறித்தபன்நோக்குஅணுகுமுறையிலானஆய்வுச்சிந்தனைமேம்பாடு.
4. வேலைவாய்ப்புக்குரியசுயதிறன்மேம்பாட்டுடன், படைப்பாக்கத்திறன்மேம்பாடும்பெற்றிருத்தல் .
5. சமுதாயமற்றும்வாழ்வியல்மதிப்புகளைப்பேணுவதற்குஉறுதுணையாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை.
6. மொழிபெயப்புத்துறைசார்ந்தவேலைவாய்புத்திறன்பெற்றிருத்தல்.

அலகு – I : தமிழ்இலக்கியவரலாறு – I (8 மணிநேரம்)

முச்சங்கவரலாறு - சங்கஇலக்கியத்தொகுப்பு -
பாட்டும்தொகையும் - சங்கஇலக்கியச்சிறப்பியல்புகள் -
சங்கம்மருவியகாலம் - பதினெண்கீழ்க்கணக்குநூல்கள் –
திருக்குறள் -நாலடியார் - நான்மணிக்கடிகை - பழமொழிநானூறு –
பிற்காலஅறஇலக்கியங்கள் - கொன்றைவேந்தன் – நீதிநூல் -
காப்பியங்கள் - தமிழில்காப்பியஇலக்கணம் -
தமிழில்பெருங்காப்பியங்களும்சிறுகாப்பியங்களும் -
இரட்டைக்காப்பியங்களாகச்சிலம்பும்மேகலையும்.

அலகு - II:சங்கஇலக்கியம் (12 மணிநேரம்)

அ).எட்டுத்தொகை

நற்றிணை : கொண்டல்மாமழை – குறிஞ்சி – தலைவன்கூற்று - 140

குறுந்தொகை : வாரார்ஆயினும், வரினும் –முல்லை– தலைவிகூற்று - 110

ஐங்குறுநூறு :மருதம் –தோழிகூற்று-வேட்கைப்பத்து: வாழிஆதன்வாழிஅவினி - 6

பதிற்றுப்பத்து : சிதைந்ததுமன்ற- 27

பரிபாடல்: புறத்திரட்டு- மதுரைநகர்ச்சிறப்பு – உலகம்ஒரு நிறையாத்தான்-7, மாயோன் கொப்பூழ்-8, செய்யாட்கு இழைத்த-9, கார்த்திகை காதில்-10, ஈவாரைக் கொண்டாடி-11.

கலித்தொகை:பாலைக்கலி- செவிலி – எறித்தரு கதிர்தாங்கி-9

அகநானூறு:அன்னைஅறியினும்அறிக – தோழி - நெய்தல் - 110

புறநானூறு :யாதும்ஊரேயாவருங்கேளிர் –பொதுவியல்- 192

ஆ). பத்துப்பாட்டு: நெடுநல்வாடை - கார்காலச்சிறப்பு : வையகம்பனிப்ப -1-70

அலகு – III : அறஇலக்கியம் (10 மணிநேரம்)

1. **திருவள்ளுவர்- திருக்குறள்**– அதிகாரம் 67 – வினைத்திட்பம், அதிகாரம் 100 - பண்புடைமை
2. **முன்றுறையரையனார் – பழமொழிநானூறு** 5 பாடல்கள் உணற்குஇனிய 5, பரந்ததிறலாரை 32, நெடியதுகாண்கிலாய் 46, இனியாரும் 153, உரைசான்ற 195.
3. **ஔவையார் – கொன்றைவேந்தன்** (1- 50 பாடல்கள்) அன்னையும்பிதாவும் – புலையும்கொலையும்களவும்தவிர்
4. **வேதநாயகம்பிள்ளை - நீதிநூல்** – (அதிகாரம்-7- தாய்தந்தையரைப் போற்றுதல்-தேர்ந்தெடுக்கப்பட்ட 5 பாடல்கள்)

சின்னவோர்பொருள், கடவுளைவருந்தி, எப்புவிகளும், வைத்தவர், ஈன்றவர்

அலகு - IV :காப்பிய இலக்கியம் (10 மணிநேரம்)

(அ). சிலப்பதிகாரம் (5மணிநேரம்)

மங்கலவாழ்த்துப்பாடல்: (21-29)- நாகநீள்நகரொடு-கண்ணகிஎன்பாண்மன்னோ .வழக்குரைகாதை, (48-56) - நீர்வார்கண்ணை-புகாரென்பதியே .

வஞ்சினமாலை: (5-34) - வன்னிமரமும் – பிறந்தபதிப்பிறந்தேன்.

நடுகற்காதை: (207-234) - அருத்திறலரசர் – மன்னவரேறென்

வாழ்த்துக்காதை: (9) - என்னேயிஃதென்னே – மீவிசும்பிற்றோன்றுமால்.

(ஆ). மணிமேகலை (5 மணிநேரம்)

பசியின்கொடுமை: பாத்திரம்பெற்றகாதை:

‘போதிநீழல்’ - ‘பெருகியதன்றோ’ , ‘ஆற்றுநர்க்களிப்போர்’ -

‘நல்லறம்கண்டனை’ (73-98).

சிறைக்கோட்டம்அறக்கோட்டமாக்கியகாதை:

மாவண்கிள்ளிக்குகாவலன்உரைத்தவை:

‘பைஞ்சேறுமெழுகாப்பசும்பொன்மண்டபத்து -
அறவோர்க்காக்கினன்அரசாள்வேந்தன்’ (116-163).

அலகு- V :அடிப்படைஇலக்கணமும்பயன்பாட்டுத்தமிழும் – I (8 மணிநேரம்)

அ).எழுத்து, சொல், பொருள் இலக்கணங்கள் (4 மணிநேரம்)

1. முதல்மற்றும்சார்பெழுத்துகள் - பெயர், வினை, இடை, உரிச்சொல்முதலானஅடிப்படைஇலக்கணவிளக்கப்பயிற்சிகள்
2). அகத்திணைமற்றும்புறத்திணைஇலக்கணங்கள்

ஆ). கடிதப்பயிற்சி (4 மணிநேரம்)

1. தன்விவரக்குறிப்புடன்வேலைவேண்டிவிண்ணப்பம்எழுதுதல்
2. பல்கலைக்கழகப்பன்னாட்டுக்கருத்தரங்கச்செய்தியைநாளித ழில்வெளியிட
   வேண்டிநாளிதழின்பதிப்பாசிரியருக்குக்கடிதம்
3. கருத்தரங்கப்பங்கேற்புக்குஅனுமதிக்கடிதம்
4. பல்கலைக்கழகவிழாவுக்குத்தலைமையேற்கவேண்டி,மாவட்ட ஆட்சியருக்குவிண்ணப்பம்
5. கல்விகடன்வேண்டிவங்கிமேலாளருக்குவிண்ணப்பம்
6. வசிப்பிடத்திற்குஅடிப்படைவசதிவேண்டிவட்டாட்சியருக்குவி ண்ணப்பம்
7. தேசியவிருதுபெற்றநண்பனுக்குப்பாராட்டுக்கடிதம்
8. புத்தகங்கள்அனுப்பிஉதவவேண்டி,

பதிப்பகத்தாருக்குவிண்ணப்பம்.

பாடநூல்:கற்பகச்சோலை – தமிழ்ஏடு.

வெளியீடு: மொழிகள் துறை – தமிழ்ப்பிரிவு,
கற்பகம்உயர்கல்விக்கழகம்.

Semester-I

21ENU101 **ENGLISH I** **4H 4C**

Instruction Hours/week:L:4 T:0 P:0 **Marks: Internal:40** **External:60** **Total:100**

End Semester Exam:3 hrs

Course Objectives

This course enables the students to

- Give basic knowledge on grammar.
- Train communication in real life situation.
- Be familiar with the four basic skills of English.
- Train students to acquire proficiency in English by reading different genres of literature and learning grammar.
- Provide aesthetic pleasure through literature.
- Develop the moral values of students.

Course Outcomes

On the successful completion of this course, the students will be able to

1. Retrieve fundaments of English language to construct error free sentences.
2. Develop the knowledge of interpersonal skills.
3. Establish and maintain social relationships.
4. Develop communication skills in business environment.
5. Refine communication competency through LSRW skills.
6. Improving intrapersonal skills through literary works

UNIT-I:**Grammar**

Types of Sentences, Subject and Predicate,Parts of Speech,Tenses, Preposition and Articles.

UNIT–II:Communication Exercise

Importance of Business Language- Words often Confused- Words often Misspelt- Common Errors in English-Charts and Pictorial Writing.

UNIT-III: **Interpersonal Skills**

Greetings & Introduction- Giving & Denying Permission- Telephone Etiquette- Oral Presentation – Plan, PowerPoint Presentation- Preparation of Speech- Audience psychology- Secrets of Good Delivery

UNIT-IV: LSRW Skills

Listening- Listening and its types, Basic Listening Lessons

Speaking- Basics of speaking, Regular English, Business English, Interview English

Reading- Reading and its purposes, Types of Reading, Reading Techniques

Writing- Types of Writing, Components of Writing, Language and Style with accordance to the contexts

UNIT-V: Literature

Prose: Let's Do What India Needs fromUs -Dr.A.P.J. Abdul Kalam

Poem: A Prayer for My Daughter - W.B. Yeats

Short Story: Sparrows- K. Ahmad Abbas

SUGGESTED READING

1. Hewings Martin, 2013Advanced Grammar in Use, Cambridge University Press.
2. Haines *Simon,2015 Advanced Skills, A resource Book of Advanced- Level Skill Activities.*

Semester-I

21CHU101 MATHEMATICS I 4H 4C

Instruction Hours/week: L: 4 T:0 P:0 Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Know the determinant, eigenvalues and eigenvectors of a real matrix.
- Provide the basic knowledge of trigonometry and hyperbolic functions.
- Give basic knowledge about mathematical concepts in differential calculus.
- The concepts of integral calculus and evaluation of different types of integrals.
- Solve the ordinary differential equations.
- Study about basic concepts in mathematics and it is useful to understand the science equations.

Course Outcomes

On the successful completion of this course, the students will be able to

1. Understanding the concept of characteristic equations to find eigen values and eigen vector.
2. Gain knowledge of trigonometric functions and related problems.
3. Achieve the knowledge of calculating higher order derivatives.
4. Evaluate definite and indefinite integrals.
5. Apply suitable methods for solving first order and second order differential equations.
6. Understood the basic concepts in mathematics and it is useful to understand the science equations.

UNIT- I: MATRICES

Definition of the Matrix – Algebra of Matrices – Types of a Matrices – Determinant – Inverse of Matrices – Eigen Values and Eigen vectors – Cayley-Hamilton theorem (without proof) – Verification and computation ofinverse.

UNIT- II: TRIGONOMETRY

Expansions of sinnθ, Cosnθ and Tannθ–Expansions of $Sin^n\theta$, $Cos^n\theta$ -Expansions of sinθ , cosθ and tanθ in terms of θ – Hyperbolic and inverse hyperbolic functions and their properties – Logarithm of a complex number – General principal values –problems.

UNIT- III: DIFFERENTIAL CALCULUS

The tangent line and the derivative of a function – Numerical differentiation, differentials of higher order derivatives, discontinuities, stationary points, maximum-minimum problems, inflexion points, limiting values of functions: L'Hospital's rule, combining limits, Calculus of several variables: Functions, change of variables, total differential, chain rule, partial differentiation, Euler's theorem.

UNIT- IV: INTEGRAL CALCULUS

Integration, odd-even functions, indefinite integrals, standard integrals, methods of integration (by part, substitution, partial fractions and other) Reduction formula.

UNIT- V: ORDINARY DIFFERENTIALEQUATIONS

Higher order linear differential equations with constant coefficients –Method of variation of parameters – Simultaneous first order linear differential equations with constant coefficients.

SUGGESTED READINGS

1. Manickavasagam Pillai.T.K , and S. Narayanan, (2002).“Calculus”, Volume I, and VolumeII S.V Printers & Publishers, Chennai, India
2. Veerarajan. T, (2011). Engineering Mathematics, Third edition, Tata McGraw-Hill Education-India.
3. Rasinghania M. D, (2017).Ordinary and Partial Differential Equations, S. Chand Publication India.
4. T. K. Manickavasagam Pillai and S. Narayanan (2004). Trigonometry, Vijay Nicole Imprints Pvt, Ltd, c-7, Nelson Manickam Road,Chennai-600029.
5. Venkataraman. M. K,(1998).Engineering Mathematics, The National Publications & Co., Chennai,India.

e-Resources

1. https://youtu.be/SJOTtb1FTfs
2. https://youtu.be/N-Ejf2jCwn4
3. https://www.youtube.com/watch?v=F2NqTIej98Q
4. https://www.digimat.in/nptel/courses/video/111105122/L01.html

Semester-I

21CHU102 **INORGANIC CHEMISTRY I: ATOMIC STRUCTURE AND CHEMICAL BONDING** **5H 5C**

Instruction Hours/week: L: 5 T:0 P:0 **Marks: Internal: 40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

Students should be able to

- Learn about the limitations of classical mechanics and its drawbacks.
- Understand the fundamentals of quantum mechanics and Schrödinger equation for simple atoms.
- Create the electronic configuration of elements.
- Know about different types of bonding like sigma and pi bonding.
- Explain different types of bonding like ionic and covalent bonding.
- Interpret the various theories of bonding like VSEPR, valence bond theory and molecular orbital theory of covalent bonding.

Course Outcomes

On the successful completion of this course, the student

1. Identify the drawbacks of classical mechanics.
2. Operate the fundamentals of quantum mechanics and Schrödinger equation for hydrogen atom.
3. Define the various rules and principles to write the electronic configuration of elements.
4. Differentiate sigma and pi bonding.
5. Have a versatile knowledge of different types of bonding like ionic and covalent bonding.
6. Distinguish the various theories of bonding like VSEPR, valence bond theory and molecular oprbital theory of covalent bonding.

UNIT I

Atomic Structure: Review of Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to atomic structure. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom.

UNIT II

Quantum Numbers: Significance of quantum numbers, Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

Types of bonding: Sigma, pi. Hydrogen bonding - Inter and intra-molecule hydrogen bonding. Van Der Walls' force- Dipole-dipole interaction, Ion-dipole interaction and London forces. Factors determining Van Der Walls forces. Electron deficient compound- Structure and bonding in diborane.

UNIT III

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

UNIT IV

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, tri-gonal planar, square planar, tetrahedral, tri-gonal bi-pyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds.

UNIT V

MO Approach: Rules for the LCAO method, bonding and anti-bonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homo-nuclear diatomic molecules of $1^{st}$and 2^{nd}periods(including idea of *s-p* mixing) and hetero-nuclear diatomic molecules such as CO, NO and NO^{+}. Comparison of VB and MO approaches.

SUGGESTED READINGS

1. Lee, J.D. (2010). Concise Inorganic Chemistry.ELBS.
2. Cotton, F.A., Wilkinson, G. &Gaus, P.L. (2008). Basic Inorganic Chemistry. 3rd ed. John Wiley &sons.
3. Madan, R. L. (2015). Chemistry for Degree Students, S. Chand & Company Pvt. Ltd.Ram Nagar, NewDelhi.
4. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. (2010).Concepts and Models in Inorganic Chemistry. John Wiley&Sons.
5. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. (2006). InorganicChemistry: Principles of Structure and Reactivity. Pearson Education India.

Semester-I

21CHU103 ORGANIC CHEMISTRY I: BASICS AND HYDROCARBONS 5H 5C

Instruction Hours/week: L:5 T:0 P:0 Marks:Internal:40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

Students should be able to

- Provide knowledge on the basics of organic chemistry.
- Gain knowledge about the shapes of molecules, electron displacement effects, reagents, intermediates and fundamental types of reactions.
- Explain the students about the stereochemistry, projection formulae of molecules, geometrical isomerism and optical isomerism.
- Explain the preparation and conformation analysis of alkanes.
- Provide knowledge on the preparation and properties of alkenes and alkynes, mechanisms of reactions and rules behind the reactions.
- Explain the aromaticity of molecules and about electrophilic aromatic substitutions.

Course Outcomes

On the successful completion of this course, the student

1. Explain the basics of organic chemistry.
2. Determine the shapes of molecules, explain the properties of molecules using electronic effects,
   knows different types of reagents, intermediates and fundamental types of reactions.
3. Differentiate the various projection formulae, geometrical isomerism and optical isomerism of
   molecules.
4. Sketch the preparation of alkanes by different methods and conformation analysis of alkanes.
5. Distinguish the preparation and properties of alkenes and alkynes, knows the mechanisms of reactions and rules behind the reactions.
6. Describe the aromaticity of molecules and about electrophilic aromatic substitution reactions.

UNIT I

Basics of Organic Chemistry

Hybridization, Shapes of molecules

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyper-conjugation and dipole moment; Hydrogen bonding (Applications to be discussed with relevant topics) Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Types, shape and relative stability of Carbocation, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions: Addition, Elimination and Substitution reactions.

UNIT II

Stereochemistry:

Fischer, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans , syn-anti and E/Z notations with C.I.P rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Diastereoisomers, meso structures, racemic mixture

and their resolution. Relative and absolute configuration: D/L and R/S designations.

UNIT III

Chemistry of Aliphatic Hydrocarbons

Carbon-Carbon sigma bonds

General methods of preparation, physical and chemical properties of alkanes: Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation-relative reactivity and selectivity.

Cycloalkanes and Conformational Analysis

Conformational analysis of alkanes: Relative stability and Energy diagrams. Types of cycloalkanes and their relative stability, Baeyer strain theory: Chair, Boat and Twist boat forms of cyclohexane with energy diagrams; Relative stability of mono substituted cycloalkanes.

Unit IV

Chemistry of Aliphatic Hydrocarbons

Carbon-Carbon pi bonds:

General methods of preparation, physical and chemical properties of alkenes and alkynes, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. Electrophilic additions and their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.

Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT V

Aromatic Hydrocarbons

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/ carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of thegroups.

SUGGESTED READINGS

1. Morrison, R. N. & Boyd, R. N. (2012). Organic Chemistry. India: Dorling Kindersley(India) Pvt. Ltd. (PearsonEducation).
2. Finar, I. L. (2012). Organic Chemistry. Volume 1. India: Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation).
3. Madan, R. L. (2015). Chemistry for Degree Students, S. Chand & Company Pvt. Ltd.Ram Nagar, New Delhi.
4. Finar, I. L. (2012). Organic Chemistry: Stereochemistry and the Chemistry ofNatural Products. Volume 2. India: Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation).
5. Eliel, E. L. & Wilen, S. H. (2010). Stereochemistry of Organic Compounds, Wiley.London
6. Kalsi, P. S. (2012). Stereochemistry Conformation and Mechanism. New AgeInternational.
7. Jain M.K. & Sharma S.C. (2015). Modern Organic Chemistry, 4thEdition, Vishal publishing Co NewDelhi.

Semester-I

21CHU111 MATHEMATICS PRACTICAL-I 4H 2C

Instruction Hours/week: L: 0 T:0 P:4 **Marks: Internal:40 External:60 Total:100**

End Semester Exam: 3hrs

Course Objectives

This course enables the students to

- Develop skills for quantitative estimation using computer language.
- Acquire problem-solving skills through computer programming.
- Code various differentiation and integration methods in a modern computer language.
- Plot the graphs of function and parametric curves.
- Code various differentiation equation and intergration equation.
- Calculatet the mean, median, and standard deviations.

Course Outcomes

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

1. Solve complicated matrix related problems like matrix inverse and matrix multiplication.
2. Acquire problem-solving skills through computer programming.
3. Describe the various differentiation and integration methods in a modern computer language.
4. Plot various functions and parametric curves.
5. Evaluate the various differentiation equation and integration equation.
6. Calculate the mean , median , standard deviations.

Contents

1. Finding addition, multiplication of two matrices.
2. Finding Inverse of a matrix and Determinant of amatrix.
3. Plotting of graphs of function e^{ax+b}, log(ax + b), 1/(ax + b), sin(ax + b), cos(ax +b), |ax +b| and to illustrate the effect of a and b on the graph.
4. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
5. Evaluating definite integrals. (Lineintegral)
6. Evaluating integrals using Reductionformulae.
7. Solution of second order ordinary differential equations with initial conditions.
8. Solving system of linear differentialEquations.

SUGGESTED READING

1. Scilab Textbook Companion for Numerical Methods for Scientists and Engineers by K. S. Rao, PHI Learning Pvt. Ltd., New Delhi, 2004.

Semester-I

21CHU112 ATOMIC STRUCTURE AND CHEMICAL BONDING - PRACTICAL **2H 1C**

Instruction Hours/week:L: 0 T:0 P:2 **Marks: Internal:40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Illustrate the principles of volumetric analysis.
- Provide a versatile knowledge of solution preparations.
- Carryout titrations with solutions of appropriate concentrations.
- How to handle the apparatus while doing a titration.
- Do the calculations involved in the estimation of compounds using volumetric analysis.
- Estimate quantitatively the amount of substance present in a solution.

Course Outcomes

On the successful completion of this course, the student

1. Summarize the principles of volumetric analysis.
2. Know to prepare solutions.
3. Understood to carryout titrations with solutions of appropriate concentrations.
4. Handle the respective apparatus while doing a titration.
5. Do and analyse the calculations involved in volumetric analysis and in the estimation of compounds using volumetric analysis.
6. Gained hands-on experience to develop and apply this knowledge.

Contents

Inorganic Chemistry - Volumetric Analysis

1. Calibration and use of apparatus.
2. Preparation of 1N solution of NaOH andHCl
3. Preparation of 1M solution of $KMnO_4$
4. Use of primary and secondary standardsolutions.
5. Estimation of sodium carbonate and sodium hydrogen carbonate present in amixture.
6. Estimation of oxalic acid by titrating it with$KMnO_4$.
7. Estimation of water of crystallization in Mohr's salt by titrating with$KMnO_4$.
8. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internalindicator.
9. Estimation of Cu (II) ions iodometrically using$Na_2S_2O_3$.

SUGGESTED READINGS

1. Svehla, G. (2012).Vogel's Qualitative Inorganic Analysis. PearsonEducation.
2. Mendham, J. (2009) Vogel's Quantitative Chemical Analysis,Pearson.

Semester-I

21CHU113 BASICS AND HYDROCARBONS–PRACTICAL 2H 1C

Instruction Hours/week: L:0T:0 P:2 **Marks: Internal:40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the student to

- Perform the purification of organic compounds by crystallisation.
- Calibrate a thermometer, determine the melting point, and to analyse the effect of impurities on the melting point.
- Determine the boiling point of a liquid by distillation method.
- Understand the principles of chromatography and to separate organic compounds by paper and thin layer chromatography.
- Demonstrate the preparation of organic compounds using standard organic reactions.
- Detect the elements present in an organic compound.

Course Outcomes

On the successful completion of this course, the student

1. Purify organic compounds by crystallisation.
2. Characterise the compounds by elemental analysis, melting point, and effect of impurities on the melting point.
3. Determine the boiling point of a liquid by distillation method.
4. Demonstrate the principles of chromatography and to separate organic compounds by paper and thin layer chromatography.
5. Prepare organic compounds by standard organic reactions.
6. Identify the elements present in an organic compound.

Contents

1. Calibration of a thermometer
2. Purification of organic compounds by crystallization using the following solvents: a.Water, b.Alcohol, c. Alcohol-Water
3. Determination of the melting points of unknown organic compounds.
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (Boiling point lower than and more than 100 °C bydistillation)
6. Chromatography
   a. Separation of a mixture of two amino acids by ascending paper chromatography
   b. Separation of a mixture of two sugars by ascending paper chromatography
   c. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography(TLC)
7. Qualitative elemental analysis (N,S,halogens)
8. OrganicPreparations
   (i) Preparation of Benzophenoneoxime.
   (ii) Preparation of Phenyl benzoate

SUGGESTED READINGS

1. Mann, F.G. & Saunders, B.C. (2009). Practical Organic Chemistry. PearsonEducation.
2. Veeraiyan V, Venkateswaran R, and Vaithiyalingam A.R. (2015). Basic Principles of Practical Chemistry, S. Chand & SonsLtd.
3. Raj K. Bansal, (2012). Laboratory Manual of Organic Chemistry, New AgeInternational Publishers (P) Ltd.
4. Thomas A.O. (2003). Practical Chemistry for B.Sc Main Students, Scientific Book Centre, Cannore-1,Kerala.
5. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell A.R. (2012).Practical OrganicChemistry.5th Ed.Pearson.

பகுதி – I, தமிழ், தாள்-2

21LSU201 தமிழ், தாள் – II 4H 4C

கற்பிக்கும்நேரம்/வாரம்: 4 மணி மதிப்பெண்: அகமதிப்பீடு / எழுத்துத்தேர்வு: 40 / 60

தேர்வு நேரம்: 3

மணிநேரம்

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும் மேம்படுத்துதல்.
- ஆய்வுநோக்கை மேம்படுத்துதல்.
- இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.
- மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.
- வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.

பாடத்திட்டப் பயன் விளைவு

1. இந்திய குடியுரிமைப் பணி முதலான போட்டித் தேர்வுகளில், விருப்பப் பாடமாக இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
3. தமிழின் வளர்ச்சித் துறையாகிய, 'அறிவியல் தமிழ்' ; 'இணைய தமிழ்' குறித்த பன்நோக்கு அணுகுமுறையிலான ஆய்வுச் சிந்தனை வளர்ச்சி.
4. வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .
5. சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்கு உறுதுணையாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை.
6. மொழிபெயப்புத் துறைசார்ந்த வேலைவாய்புத் திறன் பெற்றிருத்தல்.

அலகு – I : தமிழ் இலக்கிய வரலாறு- II (5மணிநேரம்)

தமிழ் இலக்கிய வரிசையில் திருமுறைகளும் நாலாயிரத் திவ்யப்பிரபந்தமும்-பன்னிரு திருமுறைகள் அறிமுகம்- திருமுறை ஆசிரியர்களின் இலக்கியப் பங்களிப்பு-திருமுறைகளில் பக்திநெறியும் சமுதாய நோக்கும்-சமயக்குரவரின் அருள்நெறி-பன்னிரு ஆழ்வார்கள் வரலாறு-ஆழ்வார்களின் இலக்கியப் பங்களிப்பு-திவ்யப் பிரபந்தத்தில் பக்திநெறியும் இலக்கிய நயமும்-தமிழில் சிற்றிலக்கியக் காலமும் கருத்தும்- தொண்ணூற்றாறு வகைச் சிற்றிலக்கிய வரிசை- தமிழ் மொழியின்கவிதை - சிறுகதை – உரைநடை –இலக்கியங்களின்தோற்றம் – வளர்ச்சி – உத்திகள்– நாட்டுப்புறஇலக்கியங்கள்-கொங்குநாட்டார் வாய்மொழி வழக்காறுகள்.

அலகு – II : பக்தி இலக்கியமும் சிற்றிலக்கியமும்: (12 மணிநேரம்)

அ). பக்தி இலக்கியம்(6 மணிநேரம்)

1. சைவம்- பெரியபுராணம்–இளையான்குடிமாறநாயனார் புராணம் - **(19 பாடல்கள்).**

(அம்பொன் நீடிய, கொண்டு வந்து, ஆளு நாயகர், செல்வம் மேவிய, மாரிக் காலத்து, ஈர மேனியை, நமக்கு முன்பிங்கு, செல்லல் நீங்க, மற்றம் மாற்றம், உள்ளம் அன்பு, காலினால் தடவி, வந்தபின் மனைவியாரும், முறித்தவை அடுப்பின், வழிவரும் இளைப்பினோடும், மனைவியார் கொழுநர், கணவனார் தம்மை, அழுந்திய இடருள், மாலயற் கரிய, அன்பனே அன்பர் பூசை)

2. வைணவம் – ஆண்டாள் நாச்சியார் திருப்பாவை: (11 பாடல்கள்):மார்கழித்திங்கள், வையத்து வாழ்வீர்காள், ஓங்கி உலகளந்த, ஆழி மழைக்கண்ணா, மாயனை மன்னுவட மதுரை, சிற்றம் சிறுகாலே, ஒருத்தி மகனாய், மாலே மணிவண்ணா, கூடாரை வெல்லும், கறவைகள் பின்சென்று, வங்கக்கடல் கடைந்த.

ஆ). சிற்றிலக்கியம் (6 மணிநேரம்)

1. முக்கூடற் பள்ளு- 2 பாடல்கள் - சித்திரக் காலிவாலான் (நெல்வகைகள்)
குற்றாலத் திரிகூட மால்வரை (மீன் வகைகள்)

2. நந்தி கலம்பகம்- 5 பாடல்கள்- என்னையே புகழ்ந்தேன், பதிதொறு புயல்பொழி,
இந்தப்புவியில், அடிவிளக்கும் துகில், வானுறுமதியை

3. மதுரைச் சொக்கநாதர் தமிழ்விடு தூது –தமிழின் சிறப்பு பாடியருள பத்துப்பாட்டும்-விளம்பக்கேள்.

அலகு – III:கவிதையும்சிறுகதையும் (16 மணிநேரம்)

அ). கவிதை இலக்கியம் (8 மணிநேரம்)

1. மகாகவி பாரதியார் –கண்ணன் – என்சீடன்
2. புரட்சிக்கவிஞன் பாரதிதாசன் –இளையார் ஆத்திசூடி-அழுபவன் கோழை
3. கவிமணி தேசிக விநாயகம் பிள்ளை–கோயில் வழிபாடு
4. கவிக்கோ. அப்துல்ரகுமான் –பாருக்குள்ளே நல்ல நாடு
5. சிற்பி பாலசுப்பிரமணியன் –மலையாளக் காற்று
6. கவிஞர் தாமரை –தொலைந்து போனேன்
7. கவிஞர் கரிகாலன்– விடுதலை

ஆ). சிறுகதை இலக்கியம்(8 மணிநேரம்)

1. சாபவிமோசனம் – புதுமைப்பித்தன்
2. நகரம் –சுஜாதா
3. அந்நியர்கள் –ஆர். சூடாமணி
4. இந்நாட்டு மன்னர் –நாஞ்சில்நாடன்

அலகு – IV :உரைநடை இலக்கியம் (8 மணிநேரம்)

1. ஆளுமைத்திறன் அறிவோம் - தன்னம்பிக்கை மாத இதழிலிருந்து
2. திருக்குறளும் சமுதாயவியலும் – முனைவர் புரிசை நடராசன்
3. தமிழ் – உயர்தனிச் செம்மொழி – முனைவர் இரா. குணசீலன்
4. நொய்யல் – முனைவர் ப. தமிழரசி

அலகு- V :அடிப்படை இலக்கணமும் பயன்பாட்டுத்தமிழும்– II(7மணிநேரம்)

இலக்கணப் பயிற்சி: 1. அணி இலக்கணம்

உவமையணி-பிறிது மொழிதல் அணி-சிலேடை அணி-தீவக அணி-ஏகதேச உருவக அணி – வேற்றுமையணி–பின்வருநிலையணிக்கான விளக்கங்கள்.

2. துறை சார் கலைச்சொல் பயன்பாட்டாக்கம்

3. படைப்பிலக்கியப் பயிற்சிகள்

1. மரபுக்கவிதை, புதுக்கவிதை, சிறுகதை, கட்டுரைபடைப்பாக்க உத்திகள்- பயிற்சிகள்
2. எழுத்தாளருடனான நேர்காணல் மற்றும் கள ஆய்வுக்கான வினா நிரல் தயாரித்தல் நுட்பங்களும் பயிற்சிகளும்.

4. மொழிபெயர்ப்புப்பயிற்சிகள்

1. தமிழ்-ஆங்கில மொழிபெயர்ப்புப் பயிற்சிகள் -2.
2. ஆங்கிலம்-தமிழ் மொழிபெயர்ப்புப் பயிற்சிகள்-2.

பாடநூல்:கற்பகச்சோலை – தமிழ்ஏடு.

வெளியீடு: மொழிகள் துறை – தமிழ்ப்பிரிவு, கற்பகம் உயர்கல்விக்கழகம்.

21ENU201 **ENGLISH II** **Semester-II 4H 4C**

InstructionHours/week:L:4 T:0 P:0 **Marks:Internal:40** **External: 60** **Total: 100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the student to

- Refresh the grammar knowledge of the students to improvise their language.
- Make the students to speak and write error free English.
- Make the students understand different kinds of communication.
- Develop knowledge on the business environment communication.
- Help the students develop their listening, speaking, reading and writing skills.
- Introducing literary works to the students to enhance their analytical and aesthetic skills.

Course Outcomes

On the successful completion of this course, the student

1. Strengthen the foundation of the language to elevate the command of standard grammar.
2. Inculcate the proper communication strategy.
3. Formulate and communicate persuasive arguments for specific business outcome.
4. Apply fundamentals of language for reading, writing and effective communication.
5. Standardize and demonstrate understanding of LSRW skills.
6. Introduce literature to enhance the moral and aesthetic values.

UNIT –I – Grammar

Voice,Idioms and Phrases, Clauses and Reported Speech

UNIT –II –Business and Technical Reports

Business Correspondence –Memo, Notices, Agenda, Minutes- Resume Writing- Report Writing- Letter Writing- Personal and Social Letters- E-mail Writing

UNIT –III – Communication Practice

Verbal and Non-Verbal Communication- Group Discussion and Seminars- Note-Taking and Note-Making

UNIT –IV –LSRW Skills

Listening Skills- Listening Talks and Presentations
Speaking Skills- Public Speaking- Preparatory steps, Time Management, Handling Questions and Meeting unexpected situations
Reading Skills- Language of Newspapers, Magazines and Internet
Writing Skills-Writing Paragraphs and Essays- Content Writing

UNIT –V –Literature

Prose- Morals in the Indian Context by Francis Nicholas Chelliah
Poetry- Telephone Conversation by Wole Soyinka
Short Stories-The Last Leaf by O' Henry

Books for References

Oxford Handbook of Writing: St. Martins Handbook of Writing 2013 CU Press
Sound Business, Julian Treasure 2012OUP

Semester II

21CHU201 MATHEMATICS II 4H 4C

Instruction Hours/week: L: 4 T:0 P:0 Marks:Internal: 40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Demonstrate vector differential operators to identify solenoidal and irrotational vectors.
- Get the ability of solving Partial differential equations.
- Learn about the definitions of partial differential equations
- Expand the given function into Fourier series.
- Give basic knowledge in evaluating multiple integral like double and triple integrals.
- Numerical techniques of differentiation and integration.

Course Outcomes

On successful completion of this course, the students will be able to

1. Analyzing the differential operator to find Gradient, Divergence andCurl.
2. Form and solve partial differential equations of first order
3. Define the definitions of partial differential equations.
4. Understood the nature of Fourier series that represent even and odd functions.
5. Evaluate multiple integral like double and triple integrals.
6. Apply the numerical concepts in solving the differentiation and integration.

UNIT I: VECTOR CALCULUS

Scalar and vector fields –Differentiation of vectors – Gradient, Divergence and Curl - Integration of vectors – line integral – surface integral – Green's theorem in the plane – Gauss divergence theorem – Strokes theorem – (Statements only).

UNIT II: PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations by elimination of arbitrary constants and functions - Definitions of general, particular and complete solutions - solving standard forms $f(p, q) = 0$, $f(x,p,q) = 0$, $f(y,p,q) = 0$, $f(z, p, q) = 0$, $f(x,p) = f(y,q)$, $z = px + qy + f(p,q)$ - Lagrange's Differential equations $Pp+Qq = R$.

UNIT III: FOURIER SERIES

Dirichlet's Conditions – Definition of Fourier series – Finding Fourier Coefficients for a given periodic function 2π with interval $(0,2\pi)$ and $(-\pi, \pi)$ – Odd Functions – Even functions – Half Range Sine Series – Half Range Cosine series – Harmonic Analysis.

UNIT IV: MULTIPLE INTEGRAL

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co- ordinates – Area as double integral – Volume as triple integral.

UNIT V: NUMERICAL METHODS

Solving simultaneous equations–Gauss Elimination method, Gauss Jordan method, Gauss Jacobi Method, Gauss – Seidel method. Numerical Integration – Trapezoidal Rule and Simpson's Rule.

SUGGESTED READINGS

1. Rasinghania M. D, (2017)**,** Ordinary and Partial Differential Equations, S. Chand Publication India.
2. Kandasamy, P Thilagavathy K and GunavathiK ,(2015), Numerical Methods S. Chand Publication,India.
3. Balaji. G, (2015), Engineering Mathematics-II, G.Balaji Publication,India.
4. Narayanan. S and Pillai, T. K. M (2011). Calculus Vol 1 and Vol 2, Viswanathan Publishers, India.
5. Kandasamy. P &Thilagarathy. K (2000). Mathematics for B.Sc .Vol I and. II, S. Chand and Co,India.
6. Shanthi Narayanan & Kapoor J. N (2014). A Text book of calculus, S. Chand & CoIndia.
7. S.Ranganatham&V.Rameshbabu(2014).Fourier series and integral transform, S. Chand & Co India.

e-Resources:
https://www.youtube.com/watch?v=ma1QmE1SH3I
https://youtu.be/ISqwmuGkOXQ
https://www.youtube.com/watch?v=aqu6v4vdfd4
https://www.youtube.com/watch?v=UKHBWzoOKsY

Semester-II

21CHU202 PHYSICAL CHEMISTRY I: CHEMICAL THERMODYNAMICS AND ITS APPLICATIONS **5H 4C**

Instruction Hours/week: L: 5 T:0 P:0 **Marks: Internal: 40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Remember the basics of chemical thermodynamics and the concept of first law of Thermodynamics.
- Understand the thermo chemistry and 2nd law of Thermodynamics.
- Apply the concepts of third law of thermodynamics and systems of variable composition.
- Apply the laws of chemical thermodynamics to chemical equilibrium.
- Recognise the forces which drive the chemical reactions in forward direction and the concept of the interchange of energy in a system.
- Provide a knowledge about solutions and colligative properties.

Course Outcomes

On the successful completion of this course, the student

1. Remember the basics of chemical thermodynamics and the concept of first law of thermodynamics.
2. Discuss thermo chemistry and explain the 2nd law of thermodynamics.
3. Apply the concepts of third law of thermodynamics and systems of variable composition.
4. Apply the laws of chemical thermodynamics to chemical equilibrium.
5. Recognise the forces which drive the chemical reactions in forward direction and the concept of the interchange of energy in a system.
6. Determine the molecular weight of a substance from the knowledge about solutions and colligative properties.

UNIT I

Chemical Thermodynamics*:* Intensive and extensive variables; state and path functions; isolated, closed and open systems.

First law: Concept of heat, Q, work, W, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of Q, W, ΔU and ΔH for reversible, irreversible and free expansion of gases (ideal and Van der Waals) under isothermal and adiabatic conditions.

UNIT II

Thermochemistry: Heats of reactions: standard states; enthalpy of formation and enthalpy of combustion and its applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions.

Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics. Calculation of entropy change for reversible and irreversible processes.

UNIT III

Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules. Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient

And other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

Systems of Variable Composition: Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

UNIT IV

Characteristics of chemical equilibrium: The state of chemical equilibrium, Law of mass action, Law of chemical equilibrium, Relationship between K_p and K_c , Free energy change of a reaction, Thermodynamic derivation of the law of chemical equilibrium, Equilibrium constants and their quantitative dependence on temperature, pressure and concentration (Le-Chatelier Principle, Quantitatively).

UNIT V

Solutions and Colligative Properties: Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure,

ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

SUGGESTED READINGS

1. Peter, A. & Paula, J. de.(2011).Physical Chemistry. 9th Ed. Oxford UniversityPress.
2. Castellan, G. W. (2004).Physical Chemistry. 4th Ed. Narosa.
3. Madan, R. L. (2015). Chemistry for Degree Students, S. Chand & Company Pvt. Ltd. Ram Nagar, New Delhi.
4. Engel, T. & Reid, P. (2012).Physical Chemistry. 3rd Ed.Prentice-Hall
5. McQuarrie, D. A. & Simon, J. D. (2004). New Delhi: Molecular Thermodynamics Viva Books Pvt.Ltd.
6. Assael, M. J., Goodwin, A. R. H., Stamatoudis, M., Wakeham, W. A. & Will, S. (2011). Commonly Asked Questions in Thermodynamics. NY: CRCPress.
7. Levine, I .N. (2010). Physical Chemistry.6th Ed. Tata Mc GrawHill.
8. Metz, C.R. (2006). 2000 solved problems in chemistry. SchaumSeries

Semester-II

21CHU203 ORGANIC CHEMISTRY II: 6H 5C
OXYGEN CONTAINING FUNCTIONAL GROUPS

Instruction Hours/week:L:6 T:0 P:0 **Marks: Internal:40 External: 60 Total:100**
End Semester Exam: 3hrs

Course Objectives

This course enables the student to

- Remember the chemistry of halogenated compounds like alkyl halides.
- Recall the chemistry of aryl halidies and their uses.
- Understand the preparation, properties and relative reactivity of carboxylic acids, alcohols and phenols.
- Understand the preparation, properties and standard reactions of carbonyl compounds.
- Get a knowledge on chemistry of organometallic compounds, ethers and epoxides and addition reactions.
- Analyze the chemistry of carbohydrates.

Course Outcomes

On the successful completion of this course, the student

1. Explain the chemistry of alkyl halides .
2. Discuss the chemistry of aryl halides.
3. Illustrates the preparation, properties and relative reactivity of carboxylic acid, alcohols and phenols.
4. Design the preparation, properties and standard reactions of carbonyl compounds.
5. Listout the preparations, reactions and applications of epoxides, ethers and organometallic compounds.
6. Describe the preparations, properties of carbohydrates and explain its structure.

UNIT I

Chemistry of Halogenated Hydrocarbons:

Alkyl halides*:* Methods of preparation and properties, nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent; nucleophilic substitution vs. elimination.

Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; S_NAr, Benzyne mechanism.

Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

UNIT II

Acids, Alcohols, Phenols:

Acids: General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituents on acidic strength. Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. Preperation and reactions of acid chlorides, anhydrides, esters and amides. Claisen condensation, Hofmann-bromamide degradation.

Alcohols: Preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt-Blanc Reduction; Oxidation of diols by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement;

Phenols: Preparation and properties; Acidity and factors affecting it, Ring substitution reactions, Reimer–Tiemann Reactions, Fries rearrangements with mechanism;

UNIT III

Carbonyl Compounds:

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition- elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α – substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner,$LiAlH_4$, $NaBH_4$, MPV, PDC)

UNIT IV

Organometallic Compounds, Ethers and Epoxides and Addition Reactions

Organometallic compounds of Mg (Grignard reagent) – Use in synthesis of organic compounds. **Ethers and Epoxides*:*** Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and$LiAlH_4$

Addition reactions of α, β- unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethylacetoacetate.

UNIT V

Carbohydrates

Occurrence, classification and their biological importance. Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers andanomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Inter-conversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation; Disaccharides – Structure elucidation of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch, cellulose andglycogen.

SUGGESTED READINGS

1. Morrison, R. N. & Boyd, R. N. (2012). *Organic Chemistry*. India: Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation).
2. Madan, R. L. (2015). *Chemistry for Degree Students*, S. Chand & Company Pvt. Ltd. Ram Nagar, New Delhi-110055
3. Soni, P.L. and Chawla, H.M. (2003) *Text book of Organic Chemistry*. Sulthan Chand &Sons, Educational publishers, New Delhi.
4. Finar, I. L. (2013). *Organic Chemistry.* Volume 1.Edition-VI.Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation).
5. Graham Solomons, T.W. (2012).*Organic Chemistry*. John Wiley & Sons,Inc.
6. Jain M.K. & Sharma S.C. (2015). *Modern Organic Chemistry*, 4thEdition, Vishal publishing Co NewDelhi.

Semester-II

21CHU211 **CHEMICAL THERMODYNAMICS AND ITS APPLICATIONS - PRACTICAL** **2H 1C**

Instruction Hours/week:L: 0 T:0 P:2 Marks: Internal:40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the student to

- Measure the heat capacity of a calorimeter.
- Evaluate the enthalpy of neutrilisation.
- Analyse the ionisation of a salt in a solution.
- Determine the enthalpy of hydration of salt.
- Measure the integral enthalpy of solution.
- Determine the basicity of a diprotic acid.

Course Outcomes

On the successful completion of this course, the student

1. Knows to measure the heat capacity of a calorimeter.
2. Determine the enthalpy of neutrilisation.
3. Calculate the enthalpy of ionisation.
4. Determine the enthalpy of hydration of salt.
5. Examine the integral enthalpy of solution.
6. Determine the basicity of a diprotic acid.

Contents

(a) Determination of heat capacity of a calorimeter for different volumes using (i) change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution of sulphuric acid or enthalpy of neutralization), and (ii) heat gained equal to heat lost by cold water and hot waterrespectively

(b) Determination of enthalpy of neutralization of hydrochloric acid with sodiumhydroxide.

(c) Determination of the enthalpy of ionization of ethanoicacid.

(d) Determination of integral enthalpy (endothermic and exothermic) solution ofsalts.

(e) Determination of basicity of a diprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the firststep.

(f) Determination of enthalpy of hydration ofsalt.

(g) Study of the solubility of benzoic acid in water and determination ofΔH.

SUGGESTED READINGS

1. Khosla, B. D.; Garg, V. C. & Gulati, A. (2011). *Senior Practical Physical Chemistry*. New Delhi: R. Chand &Co.
2. Athawale, V. D. & Mathur, P. (2011). *Experimental Physical Chemistry.* New Delhi: New AgeInternational.

Semester-II

21CHU212 OXYGEN CONTAINING FUNCTIONAL GROUPS-PRACTICAL **2H 1C**

Instruction Hours/week: L: 0 T:0 P:2 **Marks: Internal: 40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the student to

- Understand the organic functional groups like alcohols, phenols carbonyl and carboxylic acid groups.
- Know the methods of the preparations of organic compounds by acylation reactions.
- Demonstate the preparations of organic compounds by benzyloation reactions.
- Apply the knowledge in iodoform reactions and selective reductions.
- Apply synthetic techniques to prepare semicarbazone derivatives of ketones.
- Prepare S-benzylisothiouronium salt of aromatic acids.

Course Outcomes

On the successful completion of this course, the student

1. Identify the organic functional groups like alcohols, phenols carbonyl and carboxylic acid groups.
2. Prepare organic compounds by acylation reactions.
3. Outline the preparation of organic compounds by benzoylation reactions.
4. Demonstrate the Iodoform reactions and selective reductions.
5. Develop methods for the Preparation of semicarbazone derivatives of ketones.
6. Demonstrate the preparation of S-benzylisothiouronium salt of aromatic acids.

Contents

1. Functional group tests for alcohols, phenols, carbonyl and carboxylic acidgroup.
2. Organic preparations:

i. Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and phenols (β -naphthol, vanillin, salicylic acid) by any one method:
   a. Using conventionalmethod.
   b. Using greenapproach

ii. Benzolyation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-,p-anisidine) and one of the following phenols (β -naphthol, resorcinol, p- cresol)by Schotten-Baumann reaction.

iii. Oxidation of ethanol/ isopropanol (Iodo form reaction).

iv. Selective reduction of meta dinitrobenzene tom-nitroaniline.

v. Hydrolysis of amides and esters.

vi. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone,cyclohexanone,benzaldehyde.

vii. S-Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalicacid).

viii. Aldol condensation using either conventional or green method.

The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization and melting point.

SUGGESTED READINGS

1. Mann, F.G. & Saunders, B.C. (2009). *Practical Organic Chemistry*. Pearson Education.
2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. (2012). *Practical Organic Chemistry*. 5th Ed.,Pearson.
3. Veeraiyan V, Venkateswaran R, and Vaithiyalingam A.R. (2015). Basic Principles of Practical Chemistry, S. Chand & Sons Ltd.
4. Raj K. Bansal, (2012). Laboratory Manual of Organic Chemistry, New Age International Publishers (P)Ltd.
5. Thomas A.O. (2003). Practical Chemistry for B.Sc Main Students, Scientific Book Centre, Cannore-1,Kerala.
6. Ahluwalia, V.K. & Aggarwal, R. (2000). *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*. University Press.
7. Ahluwalia, V.K. & Dhingra, S. (2000). *Comprehensive Practical Organic Chemistry: Qualitative Analysis.* University Press.

Semester-II

21AEC201 ENVIRONMENTAL STUDIES 3H 3C

Instruction Hours/week:L: 3 T:0 P:0 Marks: Internal: 40 External: 60Total:100

End Semester Exam: 3hrs

Course Objectives

This course enables the students to

- Create the awareness about environmental problem among prople
- Integrate the knowledge from multiple disciplines representing physical and life sciences perspectives, political and economic perspectives, and social and cultural perspectives on humans' interactions with their environments
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems
- Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Prepare students for careers, citizenship and environmental stewardship through experiential curricular and co-curricular opportunities
- Students will use quantitative and qualitative research tools and techniques to analyze, implement, envision, assess, and report sustainability efforts.

Course Outcomes

On the successful completion of this course, the student

1. Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
4. Understood the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
7. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as interdisciplinary scholars and/or practitioners.

Unit I – Introduction - Environmental Studies & Ecosystems

Environment Definition, Scope and importance; Ecosystem, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem.Forest ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit II - Natural Resources - Renewable and Non-Renewable Resources

Natural resources - Renewable and Non – Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources -Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources- Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit III - Biodiversity and Its Conservation

Levels of biological diversity - genetic, species and ecosystem diversity.Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India. Biodiversity patterns (global, National and local levels). Hot-spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Unit IV - Environmental Pollution

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution. Nuclear hazards and human health risks. Solid waste management and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Case studies.

Unit V - Social Issues and The Environment

Concept of sustainability and sustainable development. Water conservation -Rain water harvesting, watershed management.Climate change, global warming, ozone layer depletion,acid rain andits impacts on human communities and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act). International agreements (Montreal and Kyoto protocols).Resettlement and rehabilitation of project affected persons. Disaster management (floods, earthquake, cyclones and landslides).Environmental Movements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness,case studies (e.g., CNG vehicles in Delhi).Human population growth: Impacts on environment, human health and welfare.

SUGGESTED READINGS

1. Anonymous. (2010). *A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research*, New Delhi.
2. Anubha Kaushik., and Kaushik, C.P. (2018). *Perspectives in Environmental*

Studies. New Age International Pvt. Ltd. Publications, NewDelhi.
3. Arvind Kumar. (2011). *A Textbook of Environmental Science*. APH Publishing Corporation, NewDelhi.
4. Daniel, B. Botkin., and Edward, A. Keller. (2014). *Environmental Science* John Wiley and Sons, Inc., NewYork.
5. Mishra, D.D. (2010). *Fundamental Concepts in Environmental Studies*. S.Chand&CompanyPvt. Ltd., NewDelhi.
6. Odum,E.P., Odum, H.T. and Andrews, J. (2004). *Fundamentals of Ecology*. Philadelphia:Saunders.
7. Rajagopalan, R. (2016). *Environmental Studies: From Crisis to Cure*, Oxford University Press**.**
8. Sing, J.S., Sing. S.P. and Gupta, S.R. (2014). *Ecology, Environmental Science and Conservation*. S. Chand & Publishing Company, NewDelhi.
9. Singh, M.P., Singh, B.S., and Soma, S. Dey. (2004). *Conservation of Biodiversity and Natural Resources*. Daya Publishing House, NewDelhi.
10. Tripathy. S.N., and Sunakar Panda. (2014). Fundamentals of Environmental Studies (2nd edition). Vrianda Publications Private Ltd, NewDelhi.
11. Verma,P.S.,andAgarwalV.K.(2018).*EnvironmentalBiology(PrinciplesofEcology).* S. Chand and Company Ltd, New Delhi.
12. Uberoi, N.K. (2010). *Environmental Studies*. Excel Books Publications, NewDelhi.

Semester-III

21CHU301	**PHYSICS I**	**4H**	**4C**

Instruction Hours/week: L: 4 T:0 P:0 **Marks: Internal:40 External: 60 Total:100**

End Semester Exam:3 hrs

Course Objectives

This course enables the students to

- Understand basic theories and experiments in physics.
- Understand the fundamentals of physics.
- Educate and motivate the students in the field of science.
- Know about anolog electronics and mechanics.
- Learn about thermal physics, optics and laser physics.
- Study about elasticity and surface tension.

Course Outcomes

On the successful completion of this course, the student

1. Demonstrate proficiency in mathematics and the mathematical concepts tounderstand physics.
2. Design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes.
3. Demonstrate an understanding of the analytical methods required tointerpret and analyze results and draw conclusions as supported by their data.
4. Knowledge about anolog electronics and mechanics.
5. Learnt about thermal physics, optics and laser physics.
6. Study about elasticity and surface tension.

UNIT-I

ELASTICITY: Elastic constants of an isotropic solid -Stress – Strain - Relations connecting them - Poisson's ratio - Bending of beams - Uniform and non-uniform bending - Bending moment of a bent beam - cantilever - Static and dynamic methods - Torsion in a wire - Rigidity modulus determination by Static and dynamic methods.

SURFACE TENSION: Surface tension and Surface energy- Angle of contact - Vapour pressure over a flat and curved surface-Hare's apparatus (Difference between two different liquids).

UNIT-II

MECHANICS: Motion of bodies in 2–D- Newton's laws - projectile motion – range-maximum height – projectile from space flight- Rotational motion – Rotation with constant angular acceleration –angular momentum of particles – rigid body – spinning top – conservation of angular momentum – Planetary motion – Kepler's laws – universal law of gravitation.

Moment of inertia of a rod, disc, spherical shell, solid and hollow spheres - Theory of compound pendulum and simple pendulum- Determination of 'g'. Relation between G and g.

UNIT-III

THERMAL PHYSICS: Laws of thermodynamics – Reversible and irreversible process – Heat engine – Carnot's theorem-Conduction- Convection- Radiation- Black body - Specific Heat- Experimental Methods- Expansion of solids, liquids and Gases (concepts)– Ideal Gas equation- Stefan's law – Newton's law of cooling – Experimental determination of Stefan's constant – Wien's displacement law – Rayleigh – Jean's law – Planck's law.

UNIT-IV

OPTICS: Nature of Light (Theories) **-** Reflection – Refraction – Snell's law – Total internal reflection – Interference – Diffraction – Polarization – Coherence-Spectrometer.
LASER PHYSICS: Stimulated emission and absorption – Einstein's theory of radiation - population inversion – optical pumping – meta stable state – conditions for laser actions – Ruby laser – Helium – neon laser – applications of lasers – Raman effect – Raman shift – stokes and anti-stokes lines – Laser Raman Spectrometer.

UNIT-V

BASIC ELECTRONICS: Intrinsic and extrinsic semiconductor – PN Junction diode – (Biasing of PN junction – V-I characteristics) – Rectifiers – Half wave – Full wave and bridge rectifiers – Characteristics of Zener diode – Voltage regulator – Transistor – Characteristics of transistor – CB, CE mode –Oscillators & its Classification.

SUGGESTED READINGS

1. Murugesan. R., Modern Physics, S.Chand& Co, NewDelhi.
2. Brijlal and N. Subramanyam, 2004, Properties of matter, S. Chand & Company, New Delhi.
3. Aruldhas and P.Rajagopal, Modern Physics, Prentice Hall of India, NewDelhi.
4. Mathur. D.S., 2003, Elements of properties of matter - Shyamlal Charitable Trust, New Delhi.
5. Principles of Electronics, V K Mehta and Rohit Mehta, S.Chand& Company Ltd. Revised Eleventh Edition2008.
6. F. W. Sears and G. L. Salinger, Thermodynamics, Kinetic theory, andStatistical Thermodynamics, IIIrded., Narosa Publishing House(1998).

Semester-III

21CHU302 **INORGANIC CHEMISTRY II: COORDINATION CHEMISTRY** **4H 4C**

Instruction Hours/week:L:4 T:0 P:0 **Marks:Internal: 40 External: 60 Total: 100**

End semester Exam: 3hrs

Course Objectives

This course enables the students to

- Remember the key features of coordination compounds.
- Understand the nomenclature, isomerism and types in coordination compounds.
- Analyse the various theories to explain the characteristics of coordination compounds.
- Understand the nature of transition elements and their compounds.
- Know about the fundamentals of Inorganic reaction mechanisms.
- Understand the stability and substitution reactionsof coordination compounds.

Course Outcomes

On the successful completion of this course, the student

1. Describe the key features of coordination compounds.
2. Understood the nomenclature, isomerism and types in coordination compounds.
3. Analyse the various theories to explain the characteristics of coordination compounds.
4. Understood the nature of transition elements and their compounds.
5. Learn about the fundamentals of Inorganic reaction mechanisms.
6. Understood the stability and substitution reactions of coordination compounds.

UNIT I

Coordination Chemistry I:

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

UNIT II

Coordination Chemistry II:

Werner's theory, valence bond theory (inner and outer orbital complexes), electro neutrality principle and back bonding. Crystal field theory, measurement of 10 Dq (Δo), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δo, Δt). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Qualitative aspect of Ligand field and MO Theory.

UNIT III

Transition Elements:

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer diagrams) Difference between the first, second and third transition series. Chemistry of Cr, Mn, Fe and Co in various oxidation states with special reference to the following compounds: peroxo compounds of chromium, potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and

sodiumcobaltinitrite.

UNIT IV

Inorganic Reaction Mechanism

Introduction to inorganic reaction mechanisms. Classification of inorganic reactions, Substitution reactions in square planar complexes,Ligand displacement reactions in Octahedral and Square planar complexes. Trans- effect, theories of transeffect.

UNIT V

Stability and Substitution Reaction in Complex

Stability of co-ordination complex, Concept of thermodynamic and Kinetic stability, Factors influence the stability of co-ordination compounds, Ligand Substitution reaction in octahedral complex, Rates and mechanism of substitution reactions, Redox reaction.

SUGGESTED READINGS

1. Cotton, F.A., Wilkinson, G. &Gaus, P.L. (2010). Advanced Inorganic Chemistry. 3rd ed.John Wiley&sons.
2. Huheey, J.E., Keiter, E.A., Keiter, R.L. &Medhi, O.K. (2013).*Inorganic Chemistry: Principles of Structure and Reactivity (10th impression)*. Pearson EducationIndia.
3. Greenwood, N.N. & Earnshaw A. (2006). *Chemistry of the Elements*. Butterworth-Heinemann. Miessler, G. L. &. Tarr, Donald A. (2009).*Inorganic Chemistry.* 3rd Ed. (adapted),Pearson.
4. Wahid U Malik, Tuli G.D., and Madan, R.D., (2009). *Selected topics in inorganic chemistry (re-print)* S.Chand& company, NewDelhi.
5. R.Gopalan and V.Ramalingam,(2015). Concise Coordination Chemistry. Vikas Publishing House.Pvt.Ltd.

Semester-III

21CHU303 PHYSICAL CHEMISTRY II: 4H 4C
PHASE EQUILIBRIUM AND CHEMICAL KINETICS

Instruction Hours/week:L: 4 T:0 P:0 Marks: Internal:40 External: 60 Total:100
End Semester Exam:3 hrs

Course Objectives

This course enables the students to

- Remember the concept of phases, components and degrees of freedom.
- Understand the theory behind three component systems.
- Explain the kinetics of different types of reactions.
- Understand the mechanisms of theories of kinetics andcatalysis.
- Know about the various types of catalyst in different chemical reactions.
- Learn about the fundamentals of surface chemistry.

Course Outcomes

On the successful completion of this course, student

1. Discuss the concept of Phase equilibrium and phase diagrams.
2. Illustrate the three component systems and their characteristic properties.
3. Determine and distinguish the rate laws for different types ofreactions.
4. Distinguish the various theories behind the chemical kinetics andcatalysis.
5. Listout the various types of catalyst in different chemical reactions.
6. Differentiate types of adsorption and adsorption isotherms in surface chemistry.

UNIT I

Phase Equilibrium: Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems (H_2O and S), with applications. Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent meltingpoints.

UNIT II

Three Component Systems: triangular plots, water-chloroform-acetic acid system. Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and non-ideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation. Nernst distribution law: its derivation and applications.

UNIT III

Chemical Kinetics: Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions upto first order only):(i) Opposing

reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions.

Unit IV

Chemical Kinetics:

Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.

Catalysis: Types of catalyst, specificity and selectivity, mechanisms of catalysed reactions at solid surfaces. Michaelis-Menten mechanism, Types of catalysis -Enzyme catalysis, acid-base catalysis and uses of catalysis in batteries.

UNIT V

Surface Chemistry: Physical adsorption, chemisorption, adsorption isotherms (Langmuir and Freundlich).nature of adsorbed state. Qualitative discussion of BET. The role of surface chemistry in chromatography (TLC and Column) and Gibb's adsorption isotherm. Emulsion in surface chemistry- Types, properties, application and mechanism of emulsification.

SUGGESTED READINGS

1. Peter Atkins & Julio De Paula. (2010). *Physical Chemistry*. 9th Ed. Oxford University Press.
2. Castellan, G. W. (2004).*Physical Chemistry*. 4th Ed.Narosa.
3. McQuarrie, D. A. & Simon, J. D. (2004). *Molecular Thermodynamics*. New Delhi: Viva Books Pvt.Ltd.
4. Engel, T. & Reid, P. (2012).*Physical Chemistry.* 3rd Ed. Prentice-Hall
5. Assael, M. J., Goodwin, A. R. H., Stamatoudis, M., Wakeham, W. A. & Will, S.(2011). *Commonly Asked Questions in Thermodynamics*. NY: CRC Press.
6. Zundhal, S.S. (2011). *Chemistry concepts and applications*. CengageIndia
7. Ball, D. W. (2012). *Physical Chemistry*. CengageIndia.
8. Mortimer, R. G. (2009).*Physical Chemistry*. 3rd Ed. Elsevier: NOIDA,UP.
9. Levine, I. N. (2011).*Physical Chemistry*. 6th Ed. Tata McGraw-Hill.
10. Metz, C. R. (2009).*Physical Chemistry*. 2nd Ed. TataMcGraw-Hill.
11. Jain and Jain (2017). *Engineering chemistry (16thEdition).*
12. Laidler, K.J (2003) Chemical Kinetics Third Edition Pearson Publications.

Semester-III

21CHU311 PHYSICS PRACTICAL-I 4H 2C

Instruction Hours/week: L: 0 T:0 P:4 Marks: Internal:40 External: 60Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Acquire basic understanding of laboratory techniques.
- Educate and motivate the students in the field of physics.
- Allow the students to have a deep knowledge of fundamentals of optics.
- Work efficient in the young modulus, rigidity modulus.
- Refractive index of a liquid prism-spectrometer.
- Thickness of a thin wire-air wedge method.

Course Outcomes

On the successful completion of this course, the student

1. Perform basic experiments in mechanics and electricity and analyze the data.
2. Acquire engineering skills and practical knowledge, which help the student in their everyday life.
3. Knowledge about the physical principles and applications of electronics.
4. Work efficiently to determine young modulus, rigidity modulus.
5. Determine refractive index of a liquid prism-spectrometer.
6. Determine thickness of a thin wire-air wedge method.

Contents

ANY TEN EXPERIMENTS

Experiments

1. Young's Modulus-Non Uniform bending-Opticlever
2. Young's Modulus-Staticcantilever
3. Acceleration due to gravity-Compound pendulum
4. Determination of spring constant of the givenspring.
5. Determine the radius of capillary tube usingmicroscope.
6. Refractive Index of a solid prism (I-d)curve-Spectrometer
7. Co-efficient of thermal conductivity-Lee's discmethod
8. Wavelength of spectral lines -Grating-minimum deviationmethod-Spectrometer.
9. Characteristics of a Zener and Junctiondiode
10. μ of a lens-Newton's ringmethod
11. Thickness of a thin wire-Air wedgemethod
12. Determine the surface tension - Drop weightmethod
13. Determine the wavelength of He-Nelaser.
14. Determination of the Coefficient of Viscosity of a given liquid using Burettemethod
15. Construct a single stage amplifier usingtransistor

SUGGESTED READINGS

1. Ouseph C.C., U.J. Rao and V. Vijayendran 2007, Practical Physics and Electronics, S.Viswanathan (Printers & Publishers) Pvt. Ltd.,Chennai
2. Singh S.P., 2003, Advanced Practical Physics – 1, 13th Edition, PragathiPrakashan, Meerut
3. Singh S.P., 2000, Advanced Practical Physics – 2, 12th Edition, PragathiPrakashan, Meerut

Semester-III

21CHU312 COORDINATION CHEMISTRY–PRACTICAL 4H 2C

Instruction Hours/week:L: 0 T:0 P:4 **Marks: Internal:40 External: 60 Total:100**

End semester Exam:3 hrs

Course Objectives

This course enables the students to

- Explain the principle of gravimetric analysis.
- Estimate the amount of nickel present in the NiDMG.
- Prepare coordination complexes.
- Measure the 10Dq by spectrophotometrically.
- Justify the properties of coordination complexes.
- Synthesise the ligand transfer reaction by substitution method.

Course Outcomes

On the successful completion of this course, the student

1. Determine metals like Ni, Cu and Fe using the principle of gravimetric analysis.
2. Estimate the amount of nickel present in the NiDMG.
3. Prepare coordination complexes.
4. Measure 10 Dq by spectrophotometric method.
5. Justify the properties of coordination complexes.
6. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g.bidentate ligands like acetylacetone, DMG, glycine) by substitution method.

Contents

Gravimetric Analysis:

i. Estimation of nickel (II) using Dimethylglyoxime (DMG).
ii. Estimation of copper as CuSCN.
iii. Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$.

Inorganic Preparations:

i. Tetraamminecopper (II) sulphate, $[Cu(NH_3)_4]SO_4.H_2O$
ii. Acetylacetonate complexes of Cu^{2+}/Fe^{3+}
iii. Tetraamminecarbonatocobalt (III)nitrate
iv. Potassiumtri(oxalato)ferrate(III)

Properties of Complexes

i. Measurement of 10 Dq by spectrophotometric method
ii. Synthesis of ammine complexes of Ni (II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetone, DMG, glycine) by substitution method.

SUGGESTED READINGS

1. Vogel, A.I. (2002).*A text book of Quantitative Analysis*.ELBS.
2. Marr, G. & Rockett, B.W. (1972). *Practical Inorganic Chemistry*. Van Nostr and Reinhold.
3. Gulati, S., Sharma, J.L. Monocha, S. (2017). *Practical Inorganic Chemistry.* CBS Publishers & Distributors, Ernakulam, Kerala.

Semester-III

21CHU313 PHASE EQUILIBRIUM AND CHEMICAL KINETICS-PRACTICAL **4H 2C**

Instruction Hours/week: L: 0 T:0 P:4 **Marks: Internal:40 External: 60 Total:100**

End Semester Exam: 3hrs

Course Objectives

This course enables the students to

- Determine the critical solution temperature (CST) and
- Determine the eutectic temperature.
- Determine distribution coefficients of two immisible solutions.
- Construct of the phase diagram using cooling curves or ignition tube method: a. simple eutectic and b. congruently melting systems.
- Apply their knowledge in Potentiometry in laboratory.
- Perform the potentiometric titrations.

Course Outcomes

On the successful completion of this course, the student

1. Apply their knowledge in Phase equilibrium.
2. Find the critical solution temperature (CST).
3. Experiment with eutectic temperature.
4. Determine the distribution coefficients of two immisible solutions.
5. Apply their knowledge in Potentiometry in the laboratory.
6. Perform the potentiometric titrations.

Contents

Phase Equilibrium

I. Determination of critical solution temperature and composition at CST of the phenol-water system

II. The effect of impurities of sodium chloride and succinic acid on CST of the phenol-water system.

III. Phase equilibria: Construction of the phase diagram using cooling curves method: a. simple eutectic

IV. Construction of the phase diagram using cooling curves method: congruently melting systems.

V. Distribution of acetic/ benzoic acid between water and chloroform orcyclohexane.

VI. Study the equilibrium of at least one of the following reactions by the distributionmethod:

(i) $I_2(aq) + I^-(aq) \rightarrow I_3(aq)$

(ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n^{2+}$

Potentiometry

V. Perform the following potentiometric titrations: i. Strong acid vs. Strong base ii. Weak acid vs. Strong base. iii. Dibasic acid vs. Strong base iv. Potassium dichromate vs. Mohr'ssalt

SUGGESTED READINGS

1. Khosla, B. D., Garg, V. C. & Gulati, A. (2011). *Senior Practical Physical Chemistry*. New Delhi: R. Chand&Co.
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. (2003).*Experiments in Physical Chemistry*. 8th Ed. McGraw-Hill: New York.
3. Halpern, A. M. &McBane, G. C. (2003). *Experimental Physical Chemistry*.3rd Ed.New York: W.H.Freeman&Co.

Semester-III

21CHU304A **PHARMACEUTICAL CHEMISTRY** **3H 3C**

Instruction Hours/week: L: 3 T:0 P:0 **Marks: Internal: 40 External: 60 Total:100**

End Semester Exam: 3hrs

Course Objectives

This course enables the students to

- Understand the drug discovery process.
- Identify and utilize the software to predict the ADMET.
- Synthesise analgesic, antipyretic and anti-inflammatory agents
- Develop the synthetic process of central nervous system and cardiovascular drugs.
- Perform the fermentation process.
- Prepare antibiotics and related compounds.

Course Outcomes

On the successful completion of this course, the student,

1. Understood the steps of drug discovery.
2. Utilise online softwares to predict ADMET parameters for a drug.
3. Apply the procedures to prepare analgesic, antipyretic, anti-inflammatory agents.
4. Synthesise central cervous cystem and cardiovascular drugs.
5. Know the fermentation process and preparation of antibiotics.
6. Prepare of antibiotics and related compounds.

UNIT 1

Drug Design and Development: Drug discovery- Stages of drug discovery, lead discovery, identification, validation and diversity of drug targets. Design and development; Basic Retrosynthetic approach. Pharmacokinetic ADMET properties, Synthon, FGI, Lipinski's rule of five, Chem-informatics tools.

UNIT II

Study on the Representative Drugs of the Following Classes: analgesic agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides, Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Anti-hypertensive drugs (Cilazapril), H1 and H2 receptor antagonists (Dimetindene), oral hypoglycemic (Omargliptin) and antineoplastic agents (Alectinib).

UNIT III

Synthesis of the representative Drugs of the following classes: Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine). Adrenergic agents (Celiprolol), cholinergic agents (Sazetidine-A), antidepressants (Vortioxetine), anticonvulsants (Levetiracetam) and psychoactive drugs (Brexpiperazole).

UNIT IV

Drug Formulation and Fermentation

Active pharmaceutical ingredient (API), Choice of the formulation,drug formulations, types, ingredients required for making a formulation, roles of excipients, Principles of fermentation, Aerobic and anaerobic fermentation. Production of Ethyl alcohol and citric acid, Enzyme kinetics and principles of enzyme inhibitors, enzyme inhibitors in medicine.

UNIT V

Anti-Biotic, Amino acid, Enzyme and Vitamins: Production of Antibiotics- Penicillin, Cephalosporin, Chloromycetin and Streptomycin. Production of amino acid- Lysine, Glutamic acid.Production of Vitamins-Vitamin B2, Vitamin B12 and Vitamin C.

SUGGESTED READINGS

1. Asthana Abhilasha, Asthana Reeteshkumar, (2016). *Text book of pharmaceuticalchemistry, S. Chand and Company.*
2. Donald cavins, (2012). *Essential of pharamaceutical chemistry (3rdEdition),*
3. Patrick, G.L. (2013). *Introduction to Medicinal Chemistry (*5thEdition). UK: Oxford UniversityPress
4. Hakishan, V.K. Kapoor, (2017). *Medicinal and Pharmaceutical Chemistry,* New Delhi: Vallabh Prakashan.Pitampura.
5. William O. Foye, Thomas L., Lemke & David A. William. (2012). *Principles of Medicinal Chemistry*. New Delhi: B.I. Waverly Pvt. Ltd.

Semester-III

21CHU304B HERBAL TECHNOLOGY AND RENEWABLE RESOURCES 3H 3C

Instruction Hours/week: L:3 T:0 P:0 Marks:Internal:40 External: 60Total:100

End Semester Exam: 3hrs

Course Objectives

This course enables the students to

- Understand herbal technology.
- Recognise the active principle in herbal products.
- Remember the botanical name of plants and names of phyto constituents.
- Evaluate the drug adulteration through the biological testing.
- Create value added processing/storage/quality control for better use of herbalmedicine.
- Create skills for cultivation of plants and their value added processing/ storage/ quality control.

Course Outcomes

On the successful completion of this course, student

1. Recognize the terms of herbal technology.
2. Define and describe the principle of making herbal products.
3. List the major herbs, their botanical name and chemicalconstituents
4. Evaluate the drug adulteration through the biological testing
5. Formulate the value added process/storage/quality control for the better use of herbal medicine.
6. Develop the skills for cultivation of plants and their value added processing/storage/quality control.

UNIT I

Herbal Technology: Definition and scope; Herbal medicines: history and scope; Traditional systems of medicine and overview of AYUSH (Traditional Indian system of medicine); Cultivation-harvesting-processing-storage of herbs and herbal products.

Herbal products recognized in India; Major herbs used as herbal medicine, nutraceuticals, cosmeticals and biopesticides.

UNIT II

Pharmacognosy- Systematic position, botany of the plant part used and active principles of the following herbs: Tulsi, Ginger, Curcuma, Fenugreek, Indian Gooseberry, Catharanthus roseus, Withaniasomnifera, Cantella asiatica, Achyranthes aspera, Kalmegh, Giloe (tinospora), Saravar. Herbal foods, future ofpharmacognosy.

UNIT III

Analytical pharmacognosy- Morphological and microscopic examination of herbs, Evaluation of drug adultration- types, methods of drug evaluation – Biological testing of herbal drugs – Phytochemical screening test for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds). Plant gene banks, Cultivation of Plants and their value added processing/ storage/ quality control for use in herbal formulations, Introductory knowledge of Tissue culture and Micro propagation of some

medicinal plants (neem and tulsi).

UNIT IV

Renewable Energies (solar): Introduction to renewable energy sources-Solar, wind, small, hydro, biomass, geothermal and ocean energy, energy flow in eco system, Solar energy resources- solar radiation, Spectrum of EM radiation, sun structure and characteristics- extra- terrestrial radiation, solar constant, air mass, beam, diffused and total solar radiation.

UNIT V

Renewable Energies (Bio gas)

Basic biomass resources: plant derived, residues, aquatic and marine biomass, various wastes, photosynthesis. Estimation- woody biomass, non woody biomass and wastes. Chemical composition of biomass cellulose, hemicelluloses and lignin content in common agriculture residues and their estimation, protein content in biomass, extractable, COD.

SUGGESTED READINGS

1. Agarwal, P. Shashi, Alok, Fathima, A. and Verma, A. (2013). *Current scenario of Herbal Technology worldwide: an overview,* Int. J. Pharm. Sci. Res; 4(11):4105-17
2. Aburjai, t. and Natesheh, F.M. (2003). *Plants used in cosmetics.* Phototherapy Research, 17; 987-1000.
3. Evans , W.C (2009): Trease and Evans PHARMACOGNOSY (16 th Edition), SAAUNDERS/Elsevier.
4. Patri, F. and Silano, V. (2002). Plants in cosmetics: plants and plant preparations used as ingredients for cosmetic products-volume1.
5. Kokate, C. K (2003). Practical Pharmacognosy. Vallabh Prakashan,pune.
6. Miller, L and Miller, B. (2017). Ayurveda & Aromatherapy: The earth Essential Guide to Ancient Wisdim and Modern Healing. *Motilal Banarsidass,(4thEdition).*
7. AYUSH-www.indianmedicine.nic.in)

Semester-III

20CHU314A PHARMACEUTICAL CHEMISTRY-PRACTICAL 3H 1C

Instruction Hours/week:L:0 T:0 P:3 **Marks:Internal:40 External: 60 Total:100**

End Semester Exam:3hrs

Course Objectives

This course enables the student to

- Develop the synthesis of pharmaceutical drugs like aspirin.
- Formulate the synthesis of magnesium bisilicate.
- Determine the melting point of aspirin.
- Characterize aspirin by spectral methods.
- Determine the melting point of antacid.
- Spectral characterization of antacid.

Course Outcomes

On the successful completion of this course, the student,

1. Synthesise pharmaceutical drugs like aspirin.
2. Synthesis magnesium bisilicate.
3. Determine the melting point of aspirin.
4. Analyse the spectral characterization of aspirin.
5. Determine the melting point of antacid.
6. Analyse the spectral characterization of antacid.

Contents

PRACTICAL'S

1. Preparation of aspirin and its analysis.
2. Preparation of magnesium bisilicate(Antacid).
3. Preparation of paracetamol
4. Preparation of metformin
5. Purification techniques of solvents by fractional distillation
6. Preparation of acid/basic salts of drugs and evaluation of their physicochemical properties (Benzilic acid & aodium benzoate).
7. Synthesis of Benzimidazole.
8. Synthesis of Sulphanilamide.

SUGGESTED READINGS

1. Patrick G.L. (2013): Introduction to *Medicinal Chemistry.* UK: Oxford UniversityPress.
2. Hakishan, V.K. Kapoor, (2017) *Medicinal and Pharmaceutical Chemistry*. New Delhi: Vallabh Prakashan.Pitampura.
3. William O. Foye, Thomas L., Lemke & David A. William. (2012). *Principles of Medicinal Chemistry*. New Delhi: B.I. Waverly Pvt.Ltd.

Semester-III

21CHU314B HERBAL TECHNOLOGY AND RENEWABLE RESOURCES- 3H 1C
PRACTICAL

Instruction Hours/week: L:0 T:0 P:3 **Marks:Internal:40 External: 60 Total:100**
End Semester Exam: 3 hrs

Course Objectives

This course enables the student to

- Remember important medicinal plants.
- Understand the procedures to extract phytoconstituents from the medicinal plants.
- Learn how to extract essential oils from plant materials.
- Know about preparation of bio-gas from kitchen waste.
- Learn about the antioxidant activity of plant materials.
- Analyze the alkaloids, flavonoids, steroids and phenolic compounds using screening test.

Course Outcomes

On the successful completion of this course, student

1. List out medicinal plants and their importance.
2. Extract phytoconstituents from the medicinalplants.
3. Extract essential oils from plant materials.
4. Understood the preparation technique of bio-gas from waste material.
5. Learned about the anti-oxidant activity of plant materials.
6. Differentiate the flavonoids, alkaloids, steroids and phenolic compounds using screening test.

Contents

a. Extraction of biologically active compounds from the followingHerbs

1. Neem
2. Turmeric
3. Tulsi
4. Ginger
5. Funegreek

b. Characterisation of plantextracts.

c. Screening test for flavonoids, alkaloids, steroids and phenoliccompounds

d. Bio-gas Production from Kitchenwaste

e. Extraction of essential oil from bark and leaves of medicinalplants.

f. Antioxidant activity of plantextracts.

SUGGESTED READINGS

1. Kokate, C. K (2003). Practical Pharmacognosy. Vallabh Prakashan, pune.
2. Aburjai, t. and Natesheh, F.M. (2003). *Plants used in cosmetics.* Phytotherapy Research, 17; 987-1000.
3. AYUSH-www.indianmedicine.nic.in)

B.Sc Chemistry **2021-2022**

Semester-IV

21CHU401 **PHYSICS II** **4H 4C**

Instruction Hours/week:L:4 T:0 P:0 **Marks: Internal:40 External: 60 Total:100**

End semester exam:3 hrs

Course Objectives:

This course enables the student to

- Understand the basic physics, theory as well as experiment.
- Gain a knowledge of elasticity of solids.
- Understand the basics of surface tension.
- Learn Eienstein's photoelectric effect.
- Knowledge about atomic and nuclear physics.
- Gain a knowledge about digital electronics.

Course Outcomes

On the successful completion of this course, the student,

1. Explain the basic natural processes of physics
2. Gained knowledge about elasticity of solids.
3. Learned about Eienstein's photoelectric effect.
4. Understood the basics of surface tension.
5. Outline atomic and nuclear physics.
6. Extend the knowledge of digital electronics.

UNIT – I

Electrostatics: Coulombs law – electric field – lines of force - electric potential – electric flux- Gauss's law and its applications – potential – potential due to various charge distribution. Parallel plate capacitors - series plate capacitor– dielectrics- current –ohm's law- resistivity- conductivity- galvanometer – voltmeter – ammeter- potentiometer- comparison of EMF of a given cell.

UNIT -II

Magnetism: Introduction to magnet- Magnetic dipole-Earth as a magnet- Coloumb's inverse square Law- Magnetic field-Tangent Galvanometer –Deflection magnetometer-Tan A position- Tan B- Tan C -Comparison of magnetic moments -Biot Savart's law – B due to a solenoid – Magnetic properties of matter –Dia, para and ferro - Cycle of magnetization – Hysteresis – B-H curve – Applications of B-H curve.

UNIT - III

Modern Physics: Einstein's Photoelectric effect- Einstein's photo electric equations- verification of Einstein's photoelectric equation by Millican's experiment–photoelectric cells – applications.

Wave Mechanics: Compton effect-matter waves-De-Broglie Hypothesis -characteristics and calculation of De Broglie wave length. Experimental study of De Broglie matter wave by G.P.Thomson experiment -Heisenberg's uncertainty principle- Applications-Schrödinger's equation- particle in a box.

UNIT-IV

Atomic and Nuclear Physics: Atom Models: Sommerfield's and Vector atom Models – Pauli's exclusion Principle – Various quantum numbers and quantization of orbits. X-rays : Continuous and Characteristic X-rays – Mosley's Law and importance – Bragg's Law.

Nuclear forces –characteristics - nuclear structure by liquid drop model – Binding energy – mass defect – Shell Model- particle accelerators – cyclotron and betatron – nuclear Fission and nuclear Fusion.

UNIT - V

Digital Electronics: Decimal – binary – octal and hexadecimal numbers– their representation, inter-conversion, addition and subtraction, negative numbers. Sum of products – product of sums – their conversion – Simplification of Boolean expressions - Basic logic gates – AND, OR, NOT, NAND, NOR and EXOR gates – NAND and NOR as universal building gates – Boolean Algebra – Laws of Boolean Algebra – De Morgan's Theorems – Their verifications using truth tables.

SUGGESTED READINGS

1. Narayanamurthi, Electricity and Magnetism, The National Publishing Co, Firstedition,1988.
2. J. B. Rajam, Atomic Physics., S. Chand & Company Limited, New Delhi, First edition,1990.
3. B. N. Srivastava, Basic Nuclear Physic, Pragati Prakashan, Meerut, 2005.
4. Albert Paul Malvino, Digital principles and Applications, McGraw-Hill International Editions, New York,2002.
5. Digital fundamentals – by Floyd 8th edition Pearson education 2006.
6. R. S. Sedha, A text book of Digital Electronics, S. Chand & Co, New Delhi, Firstedition ,2004.

Semester-IV

21CHU402 PHYSICAL CHEMISTRY III: ELECTROCHEMISTRY 4H 4C

Instruction Hours/week:L:4T:0P:0 **Marks:Internal:40 External: 60 Total:100**

End semester exam:3hrs

Course Objectives

This course enables the students to

- Analyse various types of conductance measurements and the factors affecting it.
- Understand the ionic mobilities and the applications of conductance measurements.
- Explain the basic principles of electrochemistry.
- Describe the basic concepts in electrochemical cells.
- Classify about the different types of available batteries.
- Understand the need for energy storage, devices and technologies available and their applications.

Course Outcomes

On the successful completion of this course, student

1. Understood the types of conductance measurements and the factors affecting it.
2. Discuss the ionic mobilities and the applications of conductance measurements.
3. Recognise the fundamental principles of electrochemistry.
4. Understand the basic concepts in electrochemical cells.
5. Classified about the various types of available batteries.
6. Appreciate the need for energy storage, and develop devices and technologies for such systems.

UNIT I

Conductance: Quantitative aspects of Faraday's laws of electrolysis Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules.

UNIT II

Electrochemistry: Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.

UNIT III

Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and SbO/Sb_2O_3 electrodes. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and

transference numbers. Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

UNIT IV

Electrochemical Cells: Redox reaction, electrode potential-origin of electrode potential - oxidation potential-reduction potential, measurement and applications-electrochemical series and its significance- Nernst equation (derivation and problems)

Type of Batteries: Alkaline battery-Lead storage battery-Nickel-Cadmium battery- Lithium battery and super capacitor.

Unit V

Electro-chemical energy conversion and storage

Characteristics of electricity, Electricity and the roles of EES, Emerging needs for EES, The roles of electrical energy storage technologies.

Electro-chemical energy conversion and storage: Introduction to batteries, elements and operation of electrochemical cells, theoretical cell voltage and capacity, losses in cells. Battery classification, factors effecting battery performance, Advance lead-acid batteries.

Advanced Lithium Batteries: Li-ion batteries, Principle, Battery components and design Electrode, cell and battery fabrications, Building block cells, battery modules and packs.The function of solar cells. Different solar cell technologies and fabrication methods.

SUGGESTED READINGS

1. Atkins, P.W & Paula, J.D. (2011). *Physical Chemistry (9th Edition)*. Oxford University Press.
2. Castellan, G. W. (2004).*Physical Chemistry (4th Edition)*.Narosa.
3. Mortimer, R. G. (2009).*Physical Chemistry* (*3rd Edition*). Elsevier: NOIDA,UP.
4. Barrow, G. M. (2006). *Physical Chemistry* (*5th Edition*). New Delhi: Tata McGrawHill.
5. Engel, T. & Reid, P. (2012). *Physical Chemistry* (*3rd Edition*).Prentice-Hall.
6. Rogers, D. W. (2010).*Concise Physical Chemistry*. Wiley.
7. Silbey, R. J., Alberty, R. A. &Bawendi, M. G. (2005).*Physical Chemistry* (*4th Edition*). John Wiley &Sons,Inc.

Semester-IV

21CHU403 ORGANIC CHEMISTRY III:ORGANIC SPECTROSCOPY 4H 4C

Instruction Hours/week:L:4 T:0 P:0 **Marks:Internal:40 External: 60**
Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Understand the principle and the theory behind the UV spectroscopy.
- Apply the principle and theory of IR spectroscopy to predict the structure of simple molecules.
- Analyse the principle and the theory behind the NMR spectroscopy.
- Classify the factors which affects the NMR spectral values of the compounds.
- Apply the knowledge of identification of organic compounds by using NMR spectral values.
- Discuss the basic fundamentals of mass spectroscopy.

Course Outcomes

On the successful completion of this course, the student

1. Apply the principle of the UV spectroscopy to identify structural details.
2. Implement the principle and the theory of IR spectroscopy to identify the structure of compound.
3. Use the principle and the theory of NMR spectroscopy to sketch the structure of compounds.
4. Identifies the factors affecting the NMR spectral values of the compounds.
5. Interpret the spectra to identify structure of simple molecules from their spectral values.
6. Understood the fundamentals of mass spectroscopy.

UNIT I

ORGANIC SPECTROSCOPY

General principles to absorption and emission spectroscopy.

UV Spectroscopy: Types of electronic transitions, λ_{max}, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λ_{max} for the following systems: Conjugated diens, α,β-unsaturated aldehydes, ketones, carboxylic acids andesters;

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

UNIT II

NMR Spectroscopy: Nuclear spin, Basic principles of NMR- classical and quantum mechanical method. Principle of Proton Magnetic Resonance, Spin angular momentum, Instrumentation, Relaxation: spin-spin, spin-lattice, Shielding constant, Shielding and De-shielding, Chemical Shift, Factors influencing chemical shift-Anisotropic effects.

UNIT III

NMR Spectroscopy: Spin-spin coupling, Spin decoupling, NMDR, Spin tickling, Solvents and Chemical reagents used in NMR, TMS, Coupling constant (J) and calculation, Geminal, Vicinal and Long range coupling, Factors influencing coupling constant. Introduction to ^{13}C NMR- elementary treatment.

UNIT IV

Mass spectroscopy*:* Introduction and instrumentation of Mass spectroscopy. Various methods of ionization, Rules for fragmentation, rule of 13, nitrogen rule, Even electron rule, Stevenson rule, McLafertty rearrangement, Retro Diel's Alder rearrangement. Application of fragmentation data to specific compounds (alcohol and aldehydes).

UNIT V

Problems: Application of UV and IR for identification of simple organic molecule having functional group aldehydes, ketones, acids, alcohols, ester, amine, amide.(Basic Tratment) Chemical shift and correlation of ^{1}H and ^{13}C NMR of aromatic and aliphatic (aldehydes, ketones, acids, alcohols, ester, amine, amide) (Basic Treatment)

SUGGESTED READINGS

1. Sharma Y. R., (2013). *Elementary Organic Spectroscopy: Principles and applications.* S. Chand and Company.
2. Robert Silver stein M., (2014). *Spectrometric identification of organic compounds (Revised Edition).Wiley.*
3. William Kemp. (2019).*Organic Spectroscopy (3rd Edition)*. Palgrave,USA.
4. Ahluwalia V.K., (2011). *Organic Spectroscopy*. Ane Books Pvt. Ltd.
5. Kalsi P.S., (2007). *Spectroscopy of organic compound*, New Age International Publisher.

Semester-IV

21CHU411 PHYSICS PRACTICAL-II 4H 2C

Instruction Hours/week:L:0 T:0 P:4 Marks:Internal:40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Determine field intensity-circular coil- vibration magnetometer.
- Find co-efficient of thermal conductivity-Lee's disc method.
- Determine refractive index of a prism (I-I') curve-spectrometer.
- Find the moment of a magnet-circular coil-deflection magnetometer.
- Analyse the temperature coefficient of resistance of a thermistor-post office box.
- Determine the verification of basic logic gates using discreate components.

Course Outcomes

On the successful completion of this course, student

1. Make use of field intensity-circular coil- vibration magnetometer.
2. Determine the co-efficient of thermal conductivity-Lee's disc method.
3. Calculate the refractive index of a prism (I-I') curve-spectrometer.
4. Determine moment of a magnet-circular coil-deflection magnetometer.
5. Determine temperature coefficient of resistance of a thermistor-post office box.
6. Tests for the verification of basic logic gates using discreate components.

Contents

Any 8 Experiments

1. Determine the magnetic dipole moment (*m*) of a bar magnet – Tan A
2. Determine the magnetic dipole moment (*m*) of a bar magnet – Tan B
3. Circular coil- Vibrationmagnetometer
4. Moment of a magnet-Circular coil-Deflection Magnetometer
5. Study of logic gates usingIC's.
6. Study of NOR gate as Universal buildingblock.
7. Study of NAND gate as Universal buildingblock.
8. Verification of Basic logic gates using discretecomponents.
9. Tangentgalvanometer
10. Comparison of EMF of two givencell.

SUGGESTED READINGS

1. Ouseph C.C., U.J. Rao and V. Vijayendran 2007, Practical Physics and Electronics, S.Viswanathan (Printers & Publishers) Pvt. Ltd.,Chennai
2. Singh S.P., 2003, Advanced Practical Physics – 1, 13th Edition, Pragathi Prakashan, Meerut
3. Singh S.P., 2000, Advanced Practical Physics – 2, 12th Edition, Pragathi Prakashan, Meerut

Semester-IV

21CHU412 ELECTROCHEMISTRY-PRACTICAL 4H 2C

Instruction Hours/week:L:0 T:0 P:4 Marks: Internal:40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Learn the principles of conductance measurement.
- Understand the determination of cell constant.
- Determine the strength of solution by conductometric titrations.
- Determine the kinetic aspects and rate measurements of different types of reactions.
- Determine the acid hydrolysis of methyl acetate with hydrochloric acid.
- Determine the saponification of ethyl acetate.

Course Outcomes

On the successful completion of this course student will be able to

1. Measure the conductance.
2. Determine the cell constant.
3. Perform experiments in conductometric titrations.
4. Demonstrate the kinetic aspects and rate measurements of different types of reactions.
5. Determine the acid hydrolysis of methyl acetate with hydrochloric acid.
6. Determine the saponification of ethyl acetate.

Contents

Conductometry:

I. Determination of cell constant

II. Determination of conductivity, molar conductivity, degree of dissociation and dissociation constant of a weak acid.

III. Perform the following conductometric titrations: i. Strong acid vs. strong base ii. Weak acid vs. strong base iii. Mixture of strong acid and weak acid vs. strong base iv. Strong acid vs. weak base

Chemical Kinetics:

IV. Study the kinetics of the following reactions.

1. Iodide-persulphate reaction (i) Initial rate method; (ii) Integrated rate method
2. Acid hydrolysis of methyl acetate with hydrochloric acid.
3. Saponification of ethylacetate.
4. Comparison of the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methylacetate.

SUGGESTED READINGS

1. Khosla, B. D., Garg, V. C. & Gulati, A. (2011).*Senior Practical Physical Chemistry*. New Delhi: R. Chand &Co.

2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P.(2003).*Experiments in Physical Chemistry*.8th Ed. New York : McGraw-Hill
3. Halpern, A. M. &McBane, G. C. (2003).*Experimental Physical Chemistry*. 3rd Ed. New York: W.H. Freeman & Co.

Semester-IV

21CHU413 ORGANIC SPECTROSCOPY-PRACTICAL 4H 2C

Instruction Hours/week:L:0 T:0 P:4 Marks: Internal:40 External: 60 Total:100

End Semester Exam: 3hrs

Course Objectives

This course enables the students to

- Apply the knowledge in the extraction process of biologically active compounds from tea leaves.
- Understand the preparation and characterisation of methyl orange.
- Know about the preparation of urea formaldehyde resin.
- Explain the qualitative analysis of unknown organic compounds.
- Carryout the qualitative analysis of bi-functional group in organic compounds.
- Identify the simple organic compounds from their spectral data.

Course Outcomes

On the successful completion of this course, students will be able to

1. Demonstrate the extraction of biologically active compounds from tea leaves.
2. Describe the preparation of methyl orange.
3. Discuss the preparation of urea formaldehyde resin.
4. Identify unknown organic compounds from their spectral data.
5. Carried out the qualitative analysis of bi-funcational groups.
6. Interpret the spectral data of simple organic compounds by IR spectroscopy and NMR spectroscopy.

Contents

Spectroscopic methods UV, IR and NMR

1. Extraction of caffeine from tea leaves and standardization.
2. Preparation of Methyl Orange/ urea formaldehyde resin.
3. Qualitative analysis of unknown organic compounds containing mono-functional groups(carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bi-functional groups, e.g. salicylic acid, cinnamic acid, nitro-phenols etc.
4. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to beprovided).

SUGGESTED READINGS

1. Vogel, A.I. (2012).*Quantitative Organic Analysis*. Part 3. Pearson.
2. Mann, F.G. & Saunders, B.C. (2009). *Practical Organic Chemistry*. Pearson Education
3. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. &Tatchell, A.R. (2012). *Practical Organic Chemistry*. 5th Ed. Pearson.
4. Ahluwalia, V.K. & Aggarwal, R. (2000*). Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis.* University Press.
5. Ahluwalia, V.K. & Dhingra, S. (2000).*Comprehensive Practical Organic Chemistry: Qualitative Analysis*. University Press.

Semester-IV

21CHU404A **GREEN METHODS IN CHEMISTRY** **3H 3C**

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External: 60 Total:100

End semester Exam:3 hrs

Course Objectives

This course enables the students to

- Summarize the twelve principles of green chemistry.
- Understand the significance of atom economy.
- Explain the catalysis and alternate sources of energy.
- Describe the process involved in the real word cases like surfactants for CO_2.
- Appreciate the development of synthetic azo pigments to replace toxic organic and inorganic pigments.
- Synthesise materials using a greener approach.

Course Outcomes

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

1. Summrises and appreciates the twelve principles of green chemistry.
2. Understood the significance of atom economy.
3. Critically analyse the advantages of catalysis and alternate sources of energy.
4. Describe the process involved in the real word cases like surfactants for CO_2.
5. Appreciates the use of synthetic azo pigments to replace toxic organic and inorganic pigments.
6. Synthesise materials using a greener approach.

UNIT I

Theory and Hand-On Experiments

Introduction: Definitions of Green Chemistry. Brief introduction of twelve principles of Green Chemistry, with examples, special emphasis on atom economy, reducing toxicity, green solvents,

UNITII

Source of Energy: Types of energy sources- renewable and non-renewable energy,Super Critical CO_2 and Ionic liquids, Green Chemistry and catalysis, Chemicals from renewable sources, Green energy and sustainability Green energy (micro wave, ultra sound and sona-chemist), Solar energy.

UNIT III

The Following Real World Cases In Green Chemistry Should Be Discussed:

Surfactants for carbon dioxide – Replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments. Designing of environmentally safe marine anti-foulant.

UNIT IV

Synthetic Products

Right fit pigment: Synthetic azo pigments to replace toxic organic and inorganic pigments. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.

Healthier Fats and oil by green chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils

UNIT V

Green Approach

Green Synthesis of adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis). Microwave assisted reactions in water: (Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols) and reactions in organic solvents (Diels-Alder reaction and Decarboxylation reaction). Ultrasound assisted reactions: sonochemical Simmons- Smith Reaction (Ultrasonic alternative to Iodine)

SUGGESTED READINGS

1. Anastas, P.T. & Warner, J.K. (2005).*Green Chemistry- Theory and Practical*. Oxford University Press.
2. Matlack, A.S. (2005). *Introduction to Green Chemistry*. Marcel Dekker.
3. Cann, M.C. &Connely, M.E. (2000). *Real-World cases in Green Chemistry*, American Chemical Society.Washington.
4. Ahluwalia, V.K, Kidwai, M.R, (2005). *New trends in Green Chemistry*, Anamalaya Publishers

Semester-IV

21CHU404B ANALYTICAL CLINICAL BIOCHEMISTRY 3H 3C

Instruction Hours/week: L:3 T:0 P:0 Marks:Internal: 40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Understand the basic structure of carbohydrates.
- Predict the basic structures of proteins.
- Understand the basic concept about enzymes and bio-catalysis.
- Identify and determine structures of lipids.
- Remember the basic structures of hormones.
- Analyse the biochemistry of diseases.

Course Outcomes

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

1. Understood the basic structure of carbohydrates.
2. Sketch the basic structures of protein.
3. Understood the basic concepts about enzymes and bio-catalysis.
4. Identify the basic structures of lipids.
5. Remember the functions and structures of hormones.
6. Examine the biochemistry of diseases.

Unit I

Carbohydrates*:* Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations, Krebs cycle. Isolation and characterization of poly-sachharides.

Unit II

Proteins: Classification, biological importance; Primary and secondary and tertiary structures of proteins: α-helix and β- pleated sheets, Isolation, characterization, denaturation of proteins. **Enzymes:** Nomenclature, Characteristics (mention of Ribozymes), Classification; Active site, Mechanism of enzyme action, Stereo-specificity of enzymes, Coenzymes and cofactors, Enzyme inhibitors, Factors affecting enzyme activity-effect of pH, temperature on enzyme activity, enzyme inhibition.

Introduction to Bio-catalysis: Importance in “Green Chemistry” and Chemical Industry.

Unit III

Lipids: Classification. Biological importance of triglycerides and phosphor glycerides and cholesterol; Lipid membrane, Liposomes and their biological functions and under lying applications. Lipoproteins.

Unit IV

Hormone: Properties, functions and biochemical functions of steroid hormones. Biochemistry of peptidehormones.

Nucleotides: Structure of DNA(Watson - Crick Model) and RNA, Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation, Introduction to Gene therapy.

Unit V

Biochemistry of Disease: A Diagnostic Approach by Blood/ Urine Analysis.

Blood: Composition and functions of blood, blood coagulation. Blood collection and preservation of samples .Anaemia, Regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol andbilirubin.

Urine: Collection and preservation of samples. Formation of urine. Composition and estimation of constituents of normal and pathologicalurine.

SUGGESTED READINGS

1. Cooper, T.G. (1977). *Tool of Biochemistry.* John Wiley and Sons.
2. Keith Wilson & John Walker.(2009). *Practical Biochemistry*. Cambridge University Press.
3. Alan H Gowenlock, (2005). Varley's. *Practical Clinical Biochemistry*.CBSPublisher.
4. Thomas M. Devlin. (2009). *Text book of Biochemistry*. Academic Internet Publishers.
5. Berg, J.M., Tymoczko, J.L. & Stryer, L.(2002). *Biochemistry*. W.H.Freeman.
6. Nelson, D. L. & Cox, M. M. (2008). *Lehninger's Principles of Bioch*emistry. 7th Ed.W. H. Freeman.
7. Harwood. (1990). *Series on Analytical Chemistry*. John Wiley &Son

Semester-IV

21CHU414A GREEN METHODS IN CHEMISTRY–PRACTICAL 3H 1C

Instruction Hours/week:L:0 T:0 P:3 **Marks:Internal:40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the student to

- Understand the principles and the practical aspects of green chemistry.
- Understand the preparation of biodiesel from vegetable oil.
- Demonstrate the preparation of phthalocyanine complex of Cu(II).
- Characterise the biodiesel.
- Utilize mechano chemical solvent free synthesis of azomethine.
- Construct solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper(II).

Course Outcomes

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

1. Understood the basic principles and practical aspects of green chemistry.
2. Understood the preparation and characterization of biodiesel from vegetable oil.
3. Characterize of biodiesel from vegetable oil.
4. Demonstrate the preparation of phthalocyanine complex of Cu(II).
5. Utilize mechano chemical solvent free synthesis of azomethine.
6. Construct solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper(II).

Contents

1. Preparation and characterization of biodiesel from vegetable oil.
2. Photoreduction of benzophenone to benzopinacol in presence of sunlight.
3. Mechano-chemical solvent free synthesis of azomethine.
4. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper(II).
5. Calculation of atom economy for addition, elimination, substitution and rearrangement reactions.
6. Aldol condensation in conventional and microwave assisted methods.
7. Microwave assisted reactions using green solvents.

SUGGESTED READINGS

1. Anastas, P.T. & Warner, J.K. (2005).*Green Chemistry- Theory and Practical*. Oxford University Press.
2. Matlack, A.S. (2001). *Introduction to Green Chemistry*. Marcel Dekker
3. Cann, M.C. & Connely, M.E. (2000). *Real-World cases in Green Chemistry*, American Chemical Society.Washington.
4. Ryan, M.A. &Tinnes and, M. (2002).*Introduction to Green Chemistry*. American Chemical Society.Washington.
5. Lancaster, M. (2010).*Green Chemistry: An introductory text.* (*2nd Edition*). RSC publishing.

Semester-IV

21CHU414B ANALYTICAL CLINICAL BIOCHEMISTRY– PRACTICAL **3H 1C**

Instruction Hours/week: L:0 T:0 P:3 **Marks: Internal: 40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Identify and estimate the carbohydrates.
- Estimate and identify the lipids.
- Examine the iodine number of oils.
- Determine the saponification number of oils.
- Identify the Cholesterol by using Libermann-Burchard reaction.
- Know about the isolation and identification of proteins.

Course Outcomes

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

1. Identify and estimate carbohydrates, iodine number and saponification number of oils.
2. Identify and estimate lipids.
3. Estimate the iodine number of oils.
4. Determine the saponification number of oils.
5. Identify the Cholesterol by using Libermann-Burchard reaction.
6. Know to isolate and identify proteins.

Contents

Identification and estimation of the following:

1. Carbohydrates – qualitative and quantitative.
2. Lipids –qualitative.
3. Determination of the iodine number of oil.
4. Determination of the saponification number of oil.
5. Determination of cholesterol using Liebermann- Burchard reaction.
6. Proteins–qualitative.
7. Isolation of protein.
8. Determination of protein by the Biuret reaction.
9. Determination of nucleic acids.
10. Test of urine and blood.

SUGGESTED READINGS

1. Cooper, T.G. (1977). *Tool of Biochemistry.* John Wiley and Sons.
2. Keith Wilson & John Walker. (2009).*Practical Biochemistry*. Cambridge UniversityPress.
3. Alan H Gowenlock, (2005). Varley's. *Practical Clinical Biochemistry*. CBS Publisher.
4. Thomas M. Devlin. (2009).*Textbook of Biochemistry*. Academic Internet Publishers.
5. Berg, J.M., Tymoczko, J.L. & Stryer, L. (2002). *Biochemistry*. W.H. Freeman.
6. Nelson, D. L. & Cox, M. M. (2013). *Lehninger's Principles of Bioch*emistry *(7th Edition)*W. H.Freeman.
7. Harwood. (1990). *Series on Analytical Chemistry*. John Wiley & Sons.
8. Ahluwalia, V.K. & Dhingra, S. (2000). *Comprehensive Practical Organic Chemistry: Qualitative Analysis*. University Press.

Semester-V

21CHU501A **CHEMINFORMATICS** **3H 3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:Internal:40** **External: 60** **Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Understand the principles of chem-informatics.
- Remember the representation of molecules and chemical reactions.
- Understand the search methods using chemical structures.
- Determine the properties of molecules using computational methods.
- Determine the structures using computer assisted structure elucidations.
- Analyze the chemistry related softwares and apply to predict the physio-chemical property of unknown compounds.

Course Outcomes

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

1. Understood the principles of chem-informatics.
2. Remember the representation of molecules and chemical reactions.
3. Perform the searching data on the basis chemical structures.
4. Discuss the properties of molecules using computational methods.
5. Determine structures using computer assisted structure elucidations.
6. Use the chemistry related softwares and apply it to predict the physio-chemical properties of unknown compounds.

UNIT I

Introduction To Chemo-Informatics: History and evolution of chemo-informatics, Use of chemo-informatics, Prospects of chemo-informatics, Molecular Modelling and Structure elucidation.

UNIT II

Representation of Molecules and Chemical Reactions: Nomenclature, Different types of notations, SMILES coding, Matrix representations, Structure of Mol. files and Sd. files, Libraries and toolkits, Different electronic effects, Reactionclassification.

UNIT III

Searching Chemical Structures: Full structure search, sub-structure search, basic ideas, similarity search, three dimensional search methods, basics of computation of physical and chemical data and structure descriptors, data visualization.

UNIT IV

Applications: Prediction of Properties of Compounds; Linear Free Energy Relations; Quantitative Structure-Property Relations; Descriptor Analysis; Model Building; Modelling Toxicity; Structure-Spectra correlations; Prediction of NMR, IR and Mass spectra;

UNIT-V

Software

Computer Assisted Structure elucidations; Computer Assisted Synthesis Design, Introduction to drug design; Target Identification and Validation; Lead Finding and Optimization; Analysis of HTS data; Virtual Screening; Design of Combinatorial Libraries; Ligand-Based and Structure Based Drug design; Application of Chemo-informatics in Drug Design.

SUGGESTED READINGS

1. Andrew R. Leach & Valerie, J. Gillet (2007). *An introduction to Chemoinformatics.* Springer: The Netherlands.

2. Gasteiger, J. & Engel, T. (2003). *Chemoinformatics: A text-book.*Wiley-VCH.

3. Gupta, S. P. (2011).*QSAR & Molecular Modeling.* New Delhi: AnamayaPub.

Semester-V

21CHU501B COSMETICS AND HEALTHCARE PRODUCTS 3H 3C

Instruction Hours/week: L:3 T:0 P:0 Marks:Internal:40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Uderstand the method of preparation of hair dyes, hair spray and shampoos.
- Describe the preparation and uses of lotions.
- Discuss the formulation methods of lipsticks and talcum powder.
- Understand the preparation and uses of creams.
- Explain the importance of essential oils in cosmetic industry.
- Apply the knowledge to prepare the various forms of cosmetic products.

Course Outcomes

On the successful completion of this course, students will be able to

1. Demonstrate the preparation of hair dyes, hair spray and shampoos.
2. Describe the preparation and uses of lotions.
3. Prepare the formulation methods of lipsticks and talcum powder formulations.
4. Report the preparation and uses of creams.
5. Explaine the importance of essential oil in cosmetic industry.
6. Prepare various forms of cosmetic products.

Unit I

A general study including preparation and uses of the following: Hair dye, hair spray, Shampoo.

Unit II

Preparation and uses of suntan lotions, face powder, lipsticks, talcum powder, nail enamel,

Unit III

Preparation and uses of creams (cold, vanishing and shaving creams), Soaps, Mosquitoes repellent, Chalk piece Phenoil and sanitizers, antiperspirants and artificial flavours.

Unit IV

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil

Unit V

Essential oils and their importance in cosmetic industries with reference to eucalyptus rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

SUGGESTED READINGS

1. E. Stocchi. (1990). *Industrial Chemistry*. Vol –I. UK : Ellis Horwood Ltd.
2. P.C. Jain, M. Jain (2004). *Engineering Chemistry*. Delhi: Dhanpat Rai & Sons.
3. Sharma, B.K. & Gaur, H. (1996). *IndustrialChemistry.*Meerut : Goel Publishing House.

B.Sc.Chemistry **2021-2022**

Semester-V

21CHU511A CHEMINFORMATICS-PRACTICAL 3H 1C

Instruction Hours/week: L:0 T:0 P:3 Marks:Internal:40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Apply the applications of chemiinformatics in drug design.
- Draw the chemical structure using chemdraw software.
- Perform molecular docking studies using Autodock software.
- Predict ADME properties using Swiss ADME software.
- Learn Lipinski's rule of five using Swiss ADME software.
- Predict drug likeness of a molecule.

Course Outcomes

On the successful completion of this course, students will be able to

1. Apply the applications of chemiinformatics in drug design.
2. Draw the chemical structure using chemdraw software.
3. Carryout molecular docking studies using Autodock software.
4. Predict ADME properties using Swiss ADME software.
5. Determine Lipinski's rule of five using Swiss ADME software.
6. Predict the drug likeness of a molecule

Contents

Hands-on Exercises

Application of Chemo-informatics in Drug Design.

1. Drawing structures using Mervin sketch software's.
2. Solubility of drug molecules using SWISS ADME software.
3. Determination of drug like properties using SWISS ADME software.
4. Determination of bioactivity of compounds using Molinspiration software.
5. Energy stabilisation of a drug structure using ARGUS software.
6. Demonstration of molecular docking.
7. Determination of chemical shifts in NMR spectra.

SUGGESTED READINGS

1. Andrew R. Leach & Valerie, J. Gillet. (2007). *An introduction to Chemoinformatics.* Springer: The Netherlands.
2. Gasteiger, J. & Engel, T. (2003). *Chemoinformatics: A text-book.*Wiley-VCH.
3. Gupta, S. P. (2011). *QSAR & Molecular Modeling.* New Delhi: Anamaya Pub.

Semester-V

20CHU511B COSMETICS & HEALTHCARE PRODUCTS -PRACTICAL 3H 1C

Instruction Hours/week: L: T:0 P:3 **Marks:Internal:40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the student to

- Prepare talcum powder, shampoo, hair remover, and face cream.
- Explain the formulation methods of enamles and nailpolish.
- Compare and identify the better cosmetic products.
- List out the ingredients to prepare the powder, shampoo, hair remover, face cream and enamels.
- Explain the preparation of nail polish remover.
- Apply the knowledge to study about various types of preparation techniques of cosmetics.

Course Outcomes

On the successful completion of this course, students will be able to

1. Demonstrate the preparation of talcum powder, shampoo, hair remover, and face cream.
2. Explain the formulation methods of enamels and nail polish.
3. Compare and identify the better cosmetics products.
4. List out the ingredients to prepare the powder, shampoo, hair remover, face cream, enamels.
5. Explain the preparation of nail polish remover.
6. Apply the knowledge to study about various types of preparation techniques of cosmetics.

Contents

Preparations of cosmetics and perfumes

1. Preparation of talcum powder.
2. Preparation of shampoo.
3. Preparation of enamels.
4. Preparation of hair remover.
5. Preparation of face cream.
6. Preparation of nail polish and nail polish remover.
7. Preparation of Soap.
8. Preparation of Mosquitoes repellent.
9. Preparation of Chalk piece.
10. Preparation of Sanitizers.
11. Preparation of Phenoil.

SUGGESTED READINGS

1. E. Stocchi. (1990). *Industrial Chemistry*, Vol –I. UK: Ellis Horwood Ltd.
2. P.C. Jain, M. Jain (2004). *Engineering Chemistry*. Delhi: Dhanpat Rai & Sons.
3. Sharma, B.K. & Gaur, H. (1996). *Industrial Chemistry.* Meerut: Goel Publishing House.

B.Sc.Chemistry **2021-2022**

Semester-V

21CHU502A **POLYMER CHEMISTRY** **4H 4C**

Instruction Hours/week:L:4 T:0 P:0 **Marks:Internal:40** **External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the student to

- Remember the history of polymeric materials.
- Listout the various types of polymers.
- Understand the criteria for polymerization.
- Understand the principle of kinetics of polymerization.
- Apply the knowledge to determine the molecular weight and structure property relationship.
- Critically analyse the polymer solution, physical and volumetric properties of polymers.

Course Outcomes (CO's)

On the successful completion of this course, students will be able to

1. List out the various types of polymers.
2. Explain the criteria for polymerization.
3. Determine the kinetics in polymerization.
4. Differentiate the properties of various polymers.
5. Demonstrate the molecular weight and structure property relationship.
6. Discuss the polymer solutions and its characterization.

UNIT I

Introduction and History of Polymeric Materials:

Introduction and classification including di-block, tri-block and amphiphilic polymers; Polymerisation reactions -Addition and condensation, Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

Functionality and its importance:

Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bi-functional systems, Poly-functional systems.

UNIT II

Kinetics of Polymerization:

Mechanism and kinetics of step growth, radical chain growth, free radical addition polymerization, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

Crystallization and crystallinity:

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

UNIT III

Structure of Polymers

Nature and structure of polymers-Structure Property relationships.

Determination of molecular weight of polymers (*Mn*, *Mw*, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its Significance.Poly-dispersity index.

UNIT IV

Polymer properties

Glass transition temperature (Tg) and determination of Tg, Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).

Polymer Solution – Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.

UNIT V

Polymeric Structure and Property Relationship

Structure of polymers - Linear, branched, cross linked, and network polymers, molecular weight (number average, weight average, viscosity average) and distribution of molecular weight, polydispersity index, crystallinity in polymer, melting temperature and glass transition temperature, Volumetric properties - molar volume, density, Van der Waals volume - Coefficient of linear thermal expansion and volumetric thermal expansion - Pressure volume temperature (PVT) relationship**.**

SUGGESTED READINGS

1. Seymour R.B., Charles E (2003).*Seymour's Polymer Chemistry: AnIntroduction.*
2. Marcel Dekker, Inc.G. Odian. (2004). *Principles of Polymerization*.JohnWiley.
3. F.W. Billmeyer.(1972).*Text Book of Polymer Science*.JohnWiley.
4. P. Ghosh. (2001). *Polymer Science & Technology*. TataMcgraw-Hill.
5. R.W. Lenz.(1968). *Organic Chemistry of Synthetic High Polymers*.JohnWiley.

B.Sc.Chemistry		2021-2022
		Semester-V
21CHU502B	NOVEL INORGANIC SOLIDS	4H 4C

Instruction Hours/week: L:4 T:0 P:0 **Marks:Internal:40** **External: 60 Total:100**
End Semester Exam: 3 hrs

Course Objectives

The course enables the students to

- Describe the synthesis and modification of inorganic solids.
- Understand the technological importance of inorganic solids.
- Understand the synthesis and properties of nanomaterials.
- Apply the synthesis knowledge for preparing engineering materials.
- Analyse the synthesis and properties of composite materials.
- Understand the synthesis and properties of speciality polymers.

Course Outcomes

On the successful completion of this course, students will be able to

1. Describe the synthesis and modification of inorganic solids.
2. Understood the technological importance of Inorganic Solids.
3. Illustrate the synthesis and properties of nanomaterials.
4. Execute the synthesis of engineering materials used for mechanical construction.
5. Determine the properties of composite materials.
6. Discuss the synthesis and properties of speciality polymers.

UNIT I

Synthesis and Modification of Inorganic Solids:

Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods.

Inorganic solids of technological importance:

Solid electrolytes – Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments. Molecular material and fullerides, molecular materials & chemistry–one-dimensional metals, molecular magnets, inorganic liquid crystals.

UNIT II

Nanomaterials:

Overview of nanostructures and nanomaterials: classification. Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nanoarchitecture-one dimensional control. Carbon nanotubes and inorganic nanowires. Bio-inorganic nanomaterials, DNA and nanomaterials, natural and antisical nanomaterials, bionano composites.

UNIT III

Introduction toEngineering Materials for Mechanical Construction:

Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminium and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite

materials.

UNIT IV

Composite Materials:

Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix-composites, fibre-reinforced composites, environmental effects on composites, applications of composites.

UNIT V

Speciality Polymers:

Conducting polymers - Introduction, conduction mechanism, polyacetylene, polyparaphenylene and polypyrrole, applications of conducting polymers, Ion-exchange resins and their applications. Ceramic & Refractory: Introduction, classification, properties, raw materials, manufacturing andapplications.

SUGGESTED READINGS

1. Shriver & Atkins. (2014). *Inorganic Chemistry*, Oxford University Press.
2. Peter Alkins, Tina Overton, Jonathan Rourke, Mark Weller and Fraser Armstrong. (2011-2012). 5th Edition. Oxford University Press.
3. Adam, D.M. (1974) *Inorganic Solids: An introduction to concepts in solid-state structural chemistry*. John Wiley & Sons.
4. Poole, C.P. & Owens, F.J. (2003). *Introduction to Nanotechnology.* John Wiley & Sons.
5. Rodger, G.E. (2002). *Inorganic and Solid State Chemistry*. Cengage Learning India Edition.

Semester-V

21CHU503 ORGANIC CHEMISTRY IV: 4H 4C

NITROGEN CONTAINING FUNCTIONAL GROUPS, HETEROCYCLIC CHEMISTRY AND NATURAL PRODUCTS

Instruction Hours/week:L:4 T:0 P:0 **Marks:Internal:40 External: 60 Total:100**

End semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Remember the preparation and properties of compounds with nitrogen containing functional groups.
- Understand the preparation and properties of diazonium salts and polynuclear hydrocarbons.
- Gain a knowledge in the preparation and properties of five and six membered heterocyclic compounds.
- Explain the preparation and properties of fused heterocyclic compounds.
- Understand the preparation and reactions of alkaloids.
- Explain the classification, isolation and occurrence of terpenes.

Course Outcomes

On the successful completion of this course, students will be able to

1. Remember the preparation and properties of compounds with nitrogen containing functionalgroups.
2. Understood the preparation and properties of diazonium salts and polynuclearhydrocarbons.
3. Sketch the preparation and properties of five and six membered heterocyclic compounds.
4. Develop the preparation and properties of fused heterocyclic compounds.
5. Discuss the preparation and reactions of alkaloids & terpenes.
6. Elobrate the classification, isolation and occurrence of terpenes.

UNIT I

Nitrogen Containing Functional Groups

Preparation and important reactions of nitro compounds, nitriles and isonitriles.

Amines: Preparation and properties: Effect of substituent and solvent on basicity; Gabriel phthalimide synthesis, Carbylamines reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid.

UNIT II

Diazonium Salts: Preparation, Properties and their synthetic applications.

Polynuclear Hydrocarbons

Aromaticity: Definition, Condition for aromaticity and Huckel'srule ,Aromaticity of polynuclear hydrocarbons, structure elucidation of naphthalene; Preparation and properties of naphthalene,

phenanthrene and anthracene.

UNIT III

Heterocyclic Compounds

Definition,Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis),

UNIT IV

Fused Heterocyclic Compounds

Occurrence, properties and synthesis of Indole (Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler- Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction)

UNIT V

Alkaloids

Natural occurrence, General structural features, Isolation and their physiological action, Hoffmann's exhaustive methylation, Emde's modification; Structure elucidation and synthesis of Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

Terpenes

Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral.

SUGGESTED READINGS

1. Morrison, R. T. & Boyd, R. N. (1992). *Organic Chemistry*. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. (2002). *Organic Chemistry*. Volume 1. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L.(2002).*Organic Chemistry*: *Stereochemistry and the Chemistry of Natural Products*. Volume 2. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Acheson, R.M. (1976). *Introduction to the Chemistry of Heterocyclic compounds*. John Welly & Sons.
5. Graham Solomons, T.W.(2012). *Organic Chemistry*. John Wiley & Sons,Inc.
6. Kalsi, P. S.(2009).*Textbook of Organic Chemistry*. 1st Ed. New Age International (P) Ltd. Pub.
7. Clayden, J., Greeves, N., Warren, S. &Wothers, P.(2012). *Organic Chemistry*. Oxford University Press.
8. Singh, J.; Ali, S.M. & Singh, J. (2010).*Natural Product Chemistry*. Prajati Parakashan.
9. Joule, J.A. & K. Mills.(2010)'Heterocyclc Compounds 5th Edition, John Wiley and sons. Pvt.Ltd (UK).

Semester-V

21CHU504 **INORGANIC CHEMISTRY III: METALLURGY AND S-BLOCK AND P-BLOCK ELEMENTS** **4H 4C**

Instruction Hours/week:L: 4 T:0 P:0 **Marks: Internal:40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Remember the general principles of metallurgy.
- Understand the properties of s-block elements.
- Understand the structures of complexes formed by s-block elements.
- Remember the chemistry of p-block elements.
- Discuss the oxides, hydries and oxoacids of p-block elements.
- Explain the preparation, properties, structure and uses of some types of inorganic compounds.

Course Outcomes

On the successful completion of this course, students will be able to

1. State the basic principles and methods involved in themetallurgy.
2. Explain the basic properties of s-block elements and their compounds.
3. Interpret the complex formation tendency of s-block elements and their structure.
4. List the basic properties of p-block elements and their compounds.
5. Discuss the oxides, hydries and oxoacids of p-block elements.
6. Elaborate the preparation, properties, structure and uses of borazine, silicates,silicones, Inter-halogen compounds, phosphonitrilic and clathrates.

UNIT I

General Principles of Metallurgy

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy with reference to cyanide process for silver and gold. Methods of purification of metals: Electrolytic process, Van Arkel-de Boer process and Mond's process, Zone refining.

UNIT II

Chemistry of *S* Block Elements:

(i) General characteristics: melting point, flame colour, reducing nature, diagonal relationships and anomalous behaviour of first member of each group.

(ii) Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogenandwater.

(iii) Common features such as ease of formation, thermal stability and solubility of the following alkali and alkaline earth metal compounds: hydrides, oxides, peroxides, superoxides, carbonates, nitrates, sulphates.

UNIT III

Complexes of S-Block Elements:

(i) Electronic configuration, atomic and ionic size, metallic/non-metallic character, melting point, ionization enthalpy, electron gain enthalpy, electro-negativity.

(ii) Complex formation tendency of s-block elements; structure of the followingcomplexes:crown ethers and cryptates of Group I; basic beryllium acetate, berylliumnitrate, EDTA complexes of calcium and magnesium.
(iii) Solutions of alkali metals in liquid ammonia and theirproperties.

UNIT-IV

Chemistry of *P* Block Elements:
Allotropy of C, P, S; inert pair effect, diagonal relationship between B and Si and anomalous behaviour of first member of each group.

Structure, bonding and properties: acidic/basic nature, stability, ionic/covalent nature, oxidation/reduction, hydrolysis, action of heat of the following:

Hydrides : hydridesofGroup13(onlydiborane),Group14,Group15(EH_3 whereE=N, P, As, Sb, Bi), Group 16 and Group 17.
Oxides : oxides of phosphorus, sulphur andchlorine
Oxoacids : oxoacids of phosphorus and chlorine; peroxy acids of sulphur Halides: halides of silicon andphosphorus

UNIT V

Preparation, Properties, Structure and Uses of The Following Compounds:
Borazine
Silicates, silicones,
Phosphonitrilic halides {$(PNCl_2)_n$where n = 3 and 4}
Interhalogen and pseudohalogen compounds
Clathrate compounds of noble gases, xenon fluorides (MO treatment of XeF_2).

SUGGESTED READINGS

1. Lee, J.D. (2019). *Concise Inorganic Chemistry (5thEdition)*. Pearson Education
2. Douglas .B.E, Mc Daniel, D.H. & Alexander J.J. (1997). *Concepts and Models of Inorganic Chemistry. 3rdEd.* N.Y. : John WileySons.
3. Madan, R. L. (2015*). Chemistry for Degree Students,* S. Chand & Company Pvt. Ltd. Ram Nagar, New Delhi.
4. Greenwood, N.N. & Earnshaw. (2005). *Chemistry of the Elements,* Butterworth-Heinemann.
5. Cotton, F.A. & Wilkinson, G. Carlos A. Murillo and Bochmann, (2007). *Advanced Inorganic Chemistry*. Wiley,VCH.
6. Miessler, G. L. & Donald, A. Tarr. (2011). *Inorganic Chemistry.5thEd*.(adapted).Pearson,
7. Shriver, D.F., Atkins P.W & Langford, C.H. (2010).*Inorganic Chemistry. 5thEd.* Oxford UniversityPress.
8. Huheey, J. E., Keiter, E.A. &Keiter, R.L. (2006). *Inorganic Chemistry: Principles of Structure and Reactivity.* 4thEd. Harper Collins.Pearson.

Semester-V

21CHU512A POLYMER CHEMISTRY–PRACTICAL 4H 2C

Instruction Hours/week:L:0 T:0 P:4 Marks:Internal:40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- To experience the preparation of different types of polymers by various methods.
- To understand the purification process of polymers.
- To characterise polymers by chemical methods.
- To prepare isopthaloyl chloride.
- To determine hydroxyl number of a polymer using colorimetric method.
- To analyse the polymers using instrumental method.

Course Outcomes

On the successful completion of this course, students will be able to

1. Prepare different types of polymers by various methods.
2. Understood the purification technique for few polymers.
3. Determine the properties of polymers by chemical and instrumental methods.
4. Prepare isopthaloyl chloride.
5. Determine hydroxyl number of a polymer using colorimetric method.
6. Analyse the polymers using instrumental method.

Contents

Polymersynthesis

1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid (AA).
   a. Purification ofmonomer
   b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile(AIBN)
2. Preparation of nylon 66/6
   1. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) andphenolphthalein
   a. Preparation of IPC
   b. Purification of IPC
   c. Interfacialpolymerization
3. Redox polymerization ofacrylamide
4. Precipitation polymerization of acrylonitrile
5. Preparation of urea-formaldehyde resin
6. Preparations of novalac resin/resold resin.
7. Micro-scale Emulsion Polymerization of Poly(methylacrylate).

Polymer characterization

1. Determination of molecular weight by viscometry:
   (a) Polyacrylamide-aq.$NaNO_2$ solution
   (b) (Poly vinyl proplylidine (PVP) inwater
2. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH)and the fraction of ―head-to-head monomer linkages in the polymer.
3. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).

4. Testing of mechanical properties of polymers.
5. Determination of hydroxyl number of a polymer using colorimetric method.

Polymer analysis

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method
2. Instrumental Techniques
3. IR studies of polymers
4. DSC analysis of polymers
5. Preparation of polyacrylamide and its electrophoresis

*at least 7 experiments to be carried out.

SUGGESTED READINGS

1. Malcohm P. Stevens (1999). *Polymer Chemistry: An Introduction*.3rd Ed. Oxford University Press.
2. Harry R. Allcock, Frederick W. Lampe and James E. Mark, (2003*). Contemporary Polymer Chemistry*.3rd ed. Prentice-Hall
3. Fred W. Billmeyer, (1984). *Textbook of Polymer Science*.3rd ed.Wiley-Interscience
4. Joel R. Fried, (2003). *Polymer Science and Technology*.2nd ed.Prentice-Hall.
5. Petr Munk &Tejraj M. Aminabhavi, (2002).*Introduction to Macromolecular Science*. 2nded. John Wiley &Sons
6. L. H. Sperling,.(2005). *Introduction to Physical Polymer Science*.4th ed. John Wiley & Sons.
7. Malcolm P. Stevens, (2005). *Polymer Chemistry: An Introduction*. 3rd ed. Oxford University Press.
8. Charles E. Carraher,.(2013). *Seymour/ Carraher's Polymer Chemistry*. 9th ed.Jr.

Semester-V

21CHU512B NOVEL INORGANIC SOLIDS - PRACTICAL 4H 2C

Instruction Hours/week: L:0 T:0 P:04 Marks:Internal:40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Understand the ion exchange method.
- Understand the cation exchange method.
- Summarise coprecipitation methods of novel inorganic solids.
- Discuss the method for the preparation of nanoparticles.
- Nano particle preparation using green method.
- Prepare the hydrogel by coprecipitation method.

Course Outcomes

On the successful completion of this course, students will be able to

1. Understood the cation exchange method.
2. Make use of the ion exchange method.
3. Summarize the coprecipitation methods of novel inorganic solids.
4. Develop the method for the preparation of nanoparticles.
5. Perform the Nano partical preparation using green method.
6. Prepare hydrogel by coprecipitation method.

Contents

Preparation of nano particles, co-precipitation method

1. Determination of cation exchange capacity
2. Determination of total difference of solids.
3. Synthesis of hydro-gel by co-precipitation method.
4. Synthesis of metal nano particles.
5. Interpretation of FTIR, NMR and UV-Vis data of given material.
6. Analysis of XRD pattern of few selected crystals like $NaNO_3$, $CaCl_2$, etc.; Indexing of a given powder diffraction pattern of a cubic crystalline system.
7. Estimation of particle size from the BET, and SEM techniques.

SUGGESTED READING

1. Fahlman, B.D. (2004).*Materials Chemistry,*Springer.

Semester-V

21CHU513 NITROGEN CONTAINING FUNCTIONAL GROUPS, HETEROCYCLIC CHEMISTRY AND NATURAL PRODUCTS -PRACTICAL **4H 2C**

Instruction Hours/week:L: 0 T:0 P:4 **Marks:Internal:40 External: 60 Total:100**

End semester exam: 3 hrs

Course Objectives

This course enables the students to

- Identify the presence of nitro, amine and amide groups.
- Identify qualitatively the presence of nitrogen in organic compounds.
- Identify the functional groups like phenols, carbonyl compounds and esters.
- Disinquish the various functional groups among the organic compounds.
- Observe the characteristic changes of various types of organic compounds.
- Apply this knowledge to identify the unknown or new organic compounds.

Course Outcomes

On the successful completion of this course, students will be able to

1. Identify the nitro, amine and amide groups in an organic compounds.
2. Identify qualitatively the presence of nitrogen in organic compounds.
3. Identify the functional groups like phenols, carbonyl compounds and esters.
4. Disinquish the various functional groups among the organic compounds.
5. Analyse the characteristic changes of various types of organic compounds.
6. Apply this knowledge to identify the unknown or new organic compounds.

Contents

1. Functional group test of nitro, amine and amide groups.
2. Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, carbonyl compounds and esters)
3. Identification of the nitrogen containing functional groups by spectroscopic method

SUGGESTED READINGS

1. Mann, F.G. & Saunders, B.C. (2009). *Practical Organic Chemistry*. Pearson Education
2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. (2012). *Practical Organic Chemistry*.5th Ed.Pearson.
3. Ahluwalia, V.K. & Aggarwal, R. (2000).*Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*. University Press
4. Ahluwalia, V.K. & Dhingra, S. (2000).*Comprehensive Practical Organic Chemistry: Qualitative Analysis*. University Press.

Semester-V

21CHU514 METALLURGY AND S-BLOCK AND P-BLOCK ELEMENTS -PRACTICAL **4H 2C**

Instruction Hours/week:L: 0 T:0 P:4 **Marks:Internal:40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Understand iodometric method for the metal ions estimation.
- Apply the principles of complexometric titrations using EDTA for estimation of metal ions.
- Carry out the preparations of inorganic metal complexes.
- Appreciate the importance of indicators.
- Identify various methods to estimate different metals by using EDTA method.
- Apply this knowledge to identify and estimate the metal ions in various solutions.

Course Outcomes

On the successful completion of this course, students will be able to

1. Estimate metal ions by iodometric and complexometric titration methods.
2. Demonstrate the preparation of s and p-block metal complexes.
3. Demonstrate the preparation of the inorganic metal complexes.
4. Appreciate the importance of indicator.
5. Identify various methods to to estimate different metals by using EDTA method.
6. Apply this knowledge to identify and estimate the metal ions in various solutions.

Contents

(A) Iodo / IodimetricTitrations

(i) Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodometrically).
(ii) Estimation of Potassium dichromate using sodium thiosulphate solution iodimetrically
(iii) Estimation of Iodine from common salt

(B) Complexometric titrations using disodium salt ofEDTA

(i) Estimation of Mg^{2+}, Zn^{2+}
(ii) Estimation of Ca^{2+} by substitution method
(iii) Estimation of Calcium from Milk
(iv) Estimation of Cu from brass

(C) Inorganic preparations

(i) Cuprous Chloride, Cu_2Cl_2
(ii) Manganese (III) phosphate,$MnPO_4.H_2O$
(iii) Aluminium potassium sulphate $KAl(SO_4)_2.12H_2O$ (Potash alum) or Chrome alum.

SUGGESTED READINGS

1. Vogel, A.I. (1978). A Textbook of Quantitative Inorganic Analysis,ELBS.
2. Marr, G. and Rockett, R.W. (1972). Practical Inorganic Chemistry, Van Nostrand Reinhold.
3. Deepak Pant, P. (2010). Inorganic Chemistry Practical, Book Rix.

Semester-VI

21CHU601A **ANALYTICAL CHEMISTRY** **3H 3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks: Internal: 40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

1. Familiarize with fundamentals of analytical chemistry.
2. Understand analytical tools, statistical methods applied to analytical chemistry.
3. Understand the principles of thermo-gravimetric analysis and study thermal decomposition of materials/characterization of materials.
4. Understanding the basics of electro-analytical techniques and its applications.
5. Compare and contrast various separation techniques and their applications.
6 . Understanding principles of separation technology and its use in advanced instrumentations.

Course Outcomes

On the successful completion of this course, the students will be able to

1. Discuss the fundamental aspects of analytical chemistry.
2. Discriminate various methods involved in the analytical tools, statistical methods applied to analytical chemistry.
3. Execute the principles of thermo-gravimetric analysis and study of thermal decomposition of materials/characterization of materials.
4. Discuss the basic concepts of electro-analytical techniques and its applications.
5. Compare and contrast various separation techniques and its applications.
6. Demonstrate the instrumentation for various separation methods like LC, GLC, TLC and HPLC.

UNIT I

Qualitative and quantitative aspects of analysis:

Tools in analytical chemistry and their applications, Sampling, evaluation of analytical data, errors, accuracy and precision, statistical test of data; F, Q and t-test, rejection of data, and confidence intervals.

UNIT II

Thermal analysis:

Theory and Instrumentation of thermogravimetric analysis , Thermal gravimetric Analysis(TGA),Differential Thermal Anaysis(DTA), Differential Scanning Calorimetry (DSC), Estimation of Ca and Mg from their mixture from TGA/DTA

UNIT III

Electroanalytical methods:

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and

conductometric titrations. Techniques used for the determination of equivalence points. determination of pKa values.

UNIT IV

Separation techniques:

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non aqueous media.

UNIT V

Chromatography techniques:

Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis using LC, GLC, TLC and HPLC.

SUGGESTED READING

1. Gopalan, V., Subramanian, P. S., & Rangarajan, K. (2003). *Elements of Analytical Chemistry*. New Delhi: S. Chand and Sons.
2. Usharani, S. (2002). *Analytical Chemistry*. Chennai: MacMillan India Ltd.
3. Sharma, B. K. (2019). *Instrumental Methods of Chemical Analysis* (27th Edition). Meerut: Krishna Prakashan Media (P) Ltd.

Semester-VI

21CHU601B PESTICIDE, INSECTICIDE AND HERBICIDE CHEMISTRY 3H 3C

Instruction Hours/week: L:3 T:0 P:0 **Marks: Internal: 40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Understand the synthesis and manufacture of many natural and synthetic fertilizers.
- Classify pasticides and understand tthe toxicity and action of pesticides.
- Discuss the classification, physical and chemical properties of insecticides.
- Understand the synthesis and manufacture of organochlorines and organophosphorous compounds.
- Synthesis and manufacture quinine pesticides.
- Differentiate between herbicides and weedicides.

Course Outcomes

On the successful completion of this course, the students will be able to

1. Understood the synthesis and manufacture of many natural and synthetic fertilizers.
2. Classify pasticides and understand tthe toxicity and action of pesticides.
3. Discuss the classification, physical and chemical properties of insecticides.
4. Elaborate the synthesis and manufacture of organochlorines and organophosphorous compounds.
5. Demonstrate the synthesis and manufacture of quinine pesticides.
6. Differentiate the herbicides and weedicides.

Unit I

General introduction to pesticides (natural and synthetic) and weedicides, benefits and adverse effects. Pesticide classification on use, chemical nature, formulation, toxicity and action.

Unit II

Changing concepts of pesticides, structure activity relationship.

Insecticides: Classification and Study of following insecticides with respect to structure, chemical name, Physical properties, chemical properties, Mode of action, uses and toxicity.

Organo phosphates: Acephate, Dimethoate, Chlorpyriphos.

Organochlorines: Endosulfan,

Carbamate: Cartap hydrochloride, Methomyl Coxiecarbmates.

Amides and similar functions: Rynaxypyr, Phthalic dicarboxamide,

Unit III

Synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,), Dimethyl phthalate, Ethylene oxide, Copper Sulphate.

Unit IV

Synthesis and technical manufacture and uses of Organophosphates (Malathion, Parathion); Carbamates (Carbofuranand carbaryl)

Unit V

Synthesis and technical manufacture and uses of Quinones (Chloranil), Anilides (Alachlor and Butachlor).

Herbicides and weedicides: Selective and non-selective, 2, 4-D and 2, 4, 5-t (structure and function)

SUGGESTED READING

1. Cremlyn, R. (1978). *Pesticides. Preparation and Modes of Action*. NewYork: John Wiley & Sons.

Semester-VI

21CHU611A ANALYTICAL CHEMISTRY–PRACTICAL 3H 1C

Instruction Hours/week: L:0 T:0 P:3 **Marks: Internal:40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Understand the interdisciplinary nature of analytical chemistry and the various methods involved in the analysis of soil.
- Estimate the BOD and COD level of water
- Analyse food products by using spectrometric method.
- Determine the pH values of soil, shampoo, soap and aerated drinks.
- Distinquish glucose and fructose by paper chromatography.
- Study about the concepts of flame photometry and apply it to identify the metal atoms present in various types of aerated drinks.

Course Outcomes

On the successful completion of this course, the students will be able to

1. Understood the interdisciplinary nature of analytical chemistry and the various methods involved in the analysis of soil.
2. Estimate the BOD and COD level of water.
3. Analyse food products by using spectrometric method.
4. Determine the pH values of soil, shampoo, soap and aerated drinks.
5. Distinquish the glucose and fructose by using paper chromatography.
6. Apply the concepts of flame photometry and identify the metal atoms present in various types of aerated drinks.

Contents

Experiments

1. Paper chromatographic separation of Fe^{3+}, Al^{3+}, and Cr^{3+}.
2. Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.
3. Determination of pKa values of indicator using spectrophotometry.
4. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid.
5. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid and sodium acetate and their mixtures.
6. Preparation of buffer solutions of different pH (i. Sodium acetate-acetic acid, ii. Ammonium chloride-ammonium hydroxide
7. Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions: i. Ni (II) and Co (II) ii. Fe (III) and Al (III)
8. Determine the pH of the given milk produckts like ice creams, milkshake and Badam milk.

SUGGESTED READING

1. Willard, H.H., Merritt, L.L., Dean, J. &Settoe, F.A. (1988). *Instrumental Methods of Analysis*. 7th Ed. Belmont, California, USA: Wadsworth Publishing Co. Ltd.

2. Skoog, D.A.Holler F.J.&Nieman,T.A.(1998). *Principles of Instrumental Analysis*, Cengage Learning India Ed.
3. Skoog, D.A.; West, D.M. & Holler, F.J.(1992).*Fundamentals of Analytical Chemistry* 6th Ed. Fort Worth :Saunders College Publishing.
4. Harris, D. C. (2006). *Quantitative Chemical Analysis*. W. H. Freeman and Company Ltd.,
5. Dean, J. A. (1992). *Analytical Chemistry Notebook.* McGraw Hill.
6. Day, R. A. & Underwood, A. L. (1991). *Quantitative Analysis*. Prentice Hall of India.
7. Robinson, J.W.(1995). *Undergraduate Instrumental Analysis.*5th Ed. New Delhi:Marcel DekkerInc.,

Semester-VI

21CHU611B PESTICIDE INSECTICIDE AND HERBICIDE CHEMISTRY-PRACTICAL 3H 1C

Instruction Hours/week: L:0 T:0 P:3 Marks:Internal:40 External: 60 Total:100

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Determine the acidity of pesticide formulation.
- Estimate the alkalinity of pesticideformulation.
- Synthesis of simple organophosphates.
- Understand the preparation techniques of phosphonates and thiophosphates.
- Identify the pesticide present in fruits and vegetables.
- Interpret the pesticide compounds using UV, IR, PMR and mass data.

Course Outcomes

On the successful completion of this course, the students will be able to

1. Evaluate acidity in given sample of pesticide formulation.
2. Estimate the alkalinity in given sample of pesticide formulation.
3. Carryout the synthesis of simple organophosphates.
4. Prepare the phosphonates andthiophosphates.
5. Identify the pesticide present in fruits and vegetables.
6. Interpret the pesticide compounds using spectral data.

Contents

1. To calculate acidity/alkalinity in given sample of pesticide formulations.
2. Preparation of simple organophosphates, phosphonates and thiophosphates.
3. Analysis of pesticides in fruits and vegetables.
4. Analysis of pesticides on the basis of given UV, IR, PMR and Mass data.

SUGGESTED READING

1. Cremlyn, R. (1978). *Pesticides. Preparation and Modes of Action*. New York: John Wiley & Sons.

Semester-VI

21CHU602 **INORGANIC CHEMISTRY IV: ORGANOMETALLIC CHEMISTRY** **4H 4C**

Instruction Hours/week:L:4 T:0 P:0 **Marks:Internal:40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- To remember the theoretical principles in qualitative analysis to identify the cations and anions.
- To understand the classification of organometallic compounds based on bond type.
- To analyse few important metal complexes of commercial importance.
- To understand the catalytic property of organometallic compounds.
- To distinquish the ferrocene and benzene compounds.
- To analyse the Metal ions present in biological systems.

Course Outcomes

On the successful completion of this course, the students will be able to

1. State the theoretical principles in qualitative analysis to identify the cations andanions.
2. Discriminate the types of organometallic compounds based on bond type.
3. Discuss the commercial importance of important metal complexes.
4. Describe the catalytic property of organometallic compounds.
5. Distinquish the ferrocene structure, properties from benzene.
6. Explain the importance of metal ions present in biological systems.

UNIT I

Theoretical Principles in Qualitative Analysis (H_2S Scheme)

Basic principles involved in analysis of cations and anions. Solubility products, common ion effect. Principals involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.

UNIT II

Organometallic Compounds

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT.

UNIT III

Metal Carbonyls and Metal Alkyls

Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.

Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds.

UNIT IV

Reaction in Aromatic Benzene

Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene.

EAN rule as applied to carbonyls, preparation, properties and structure of polynuclear carbonyls, VB and MO diagram of CO can be referred for synergic effect to IR frequencies.

UNIT V

Application of Organometallic Compounds

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxy peptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cisplatin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin; Storage and transfer of iron.

Application in catalysis process-Wilkinson's catalyst, Ziegler-Natta catalyst

SUGGESTED READINGS

1. Cotton, F.A., Wilkinson, G., &Gaus, P.L. (1993). *Basic Inorganic Chemistry*.3rd Ed. WileyIndia.
2. Huheey, J. E., Keiter, E.A. &Keiter, R.L. (2006). *Inorganic Chemistry: Principles of Structure and Reactivity.* 4thEd. Harper Collins. Pearson.
3. Sharpe, A.G. (2005). *Inorganic Chemistry*, 4th Indian Reprint. Pearson Education.
4. Douglas, B. E.; McDaniel, D.H. & Alexander, J.J.(1994).*Concepts and Models in Inorganic Chemistry (*3rdEdition). NY*:* John Wiley and Sons.
5. Greenwood, N.N.& Earnshaw, A. (1997). *Chemistry of the Elements (*2nd Edition), Elsevier, (Ziegler Natta Catalyst and Equilibria in Grignard Solution).
6. Lee, J.D. (2008). *Concise Inorganic Chemistry* (5thEdition). John Wiley and sons.
7. Powell, P. (1988). *Principles of Organometallic Chemistry*, Chapman and Hall.
8. Shriver, D.D., Atkins, P. and Langford, C.H. (1994). *Inorganic Chemistry (*2nd Edition). Oxford University Press.
9. Miessler, G. L. &Tarr, Donald A. (2010).*Inorganic Chemistry (*4th Edition). Pearson.
10. Crabtree, Robert H. (2000). *The Organometallic Chemistry of the Transition Metals*. NY: John Wiley NewYork.
11. Spessard, Gary O., &Miessler, Gary L. (1996). *Organometallic Chemistry*. Upper Saddle River, NJ:Prentice-Hall.

Semester-VI

21CHU603 PHYSICAL CHEMISTRY IV: STATES OF MATTER AND IONIC EQUILIBRIUM **4H 4C**

Instruction Hours/week:L: 4 T:0 P:0 **Marks:Internal:40 External: 60 Total:100**
End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

- Remember the kinetic molecular model of a gas and about the molecular velocities.
- Understand the behaviour of real gases.
- Understand the structure of the liquid state and its properties like surface tension and viscosity.
- Analyse the solid state, symmetries present and different types of crystals.
- Remember the theory of ionic equilibria, ionisation of electrolytes and salt hydrolysis.
- Prepare the buffer solutions for acid-base titrations.

Course Outcomes

On the successful completion of this course, the students will be able to

1. State the postulates of kinetic theory of gases, kinetic molecular model of gases and about the molecularvelocities
2. Explain, why real gases deviate from ideal gases, Vander Waals equation of state and about critical constants.
3. Correlate the structure of the liquid state and its properties.
4. Distinguish the solid state, symmetries present and different types of crystals.
5. Explain the theory of ionic equilibria, ionisation of electrolytes and salt hydrolysis.
6. Formulate the buffer solutions and the choice of indicators to acid-base titrations.

UNIT I

Gaseous State: Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free pathand coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equi-partition of energy, degrees of freedom and molecular basis of heatcapacities.

UNIT II

Behaviour of Real Gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure and temperature for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation and application in explaining real gas behaviour, calculation of Boyle temperature. Isotherms of real gases and their comparison with Van der Waals isotherms, continuity of states, critical state, relation between critical constants and Van der Waals constants, law of correspondingstates.

Liquid state: Qualitative treatment of the structure of the liquid state; physical properties of liquids, vapour pressure, surface tension coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that ofgases.

UNIT III

Solid State: Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl andKCl.

UNIT IV

Ionic Equilibria: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acidsand bases, pH scale, common ion effect; Ostwald dilution law, dissociation constants of mono and diprotic acids. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for differentsalts.

UNIT V

Electro-Chemistry: Buffer solutions; derivation of Henderson equation and its applications. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid– base indicators; selection of indicators and their limitations.

SUGGESTED READINGS

1. Atkins, P. W. & Paula, J. de Atkin's. (2006). *Physical Chemistry.* Oxford University Press.
2. Ball D. W. (2007). *Physical Chemistry*. India: Thomson Press.
3. Madan, R. L. (2015). *Chemistry for Degree Students,* S. Chand & Company Pvt. Ltd. Ram Nagar, New Delhi.
4. Castellan, G. W. (2004). *Physical Chemistry* (*4th Edition*). Narosa.
5. Mortimer, R. G. (2009). *Physical Chemistry* (*3rd Edition*). NOIDA, UP:Elsevier.

Semester-VI

21CHU612 ORGANOMETALLIC CHEMISTRY-PRACTICAL 4H 2C

Instruction Hours/week:L:0 T:0 P:4 Marks: Internal:40 External: 60 Total:100

End Semester Exam:3 hrs

Course Objectives

This course enables the students to

- Understand how to identify the anions and the cations in a mixture by qualitative semi-microanalysis.
- Identify the interfering anions.
- Remember the principles behind the spot tests.
- Observe the characteristics of various metal ions.
- Classify the characteristics of various anions.
- Apply the principles of chromatography for ion separations.

Course Outcomes

On the successful completion of this course, the students will be able to

1. Identify the anions and the cations in a mixture by qualitative semi microanalysis.
2. Eliminate the interfering anions.
3. Carryout the spot tests.
4. Observe the characteristics of various metal ions.
5. Classify the characteristic of various anions.
6. Separate metal ion using chromatographic technique.

Contents

Qualitative semi-micro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:

CO_3^{2-}, NO^{2-}, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I-, NO^{3-}, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-}, NH^{4+}, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}, Sb^{3+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}

Mixtures should preferably contain one interfering anion, **or** insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) **or** combination of anions e.g. CO_3^{2-} and SO_3^{2-}, NO_2^- and NO_3^-, Cl^- and Br^-, Cl^- and I-, Br-and I, NO_3^- and Br^-, NO_3^- and I^-

Spot tests should be done whenever possible.

Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:

i. Ni (II) and Co (II)

ii.Cu (II) and Cd(II)

SUGGESTED READING

1. Svehla,G. (1996)Vogel's *Qualitative Inorganic Analysis*, Longman, NewYork.

21CHU613 **STATES OF MATTER AND IONIC EQUILIBRIUM–PRACTICAL** **4H 2C**

Instruction Hours/week:L: 0 T:0 P:4 **Marks:Internal:40 External: 60 Total:100**

End Semester Exam: 3 hrs

Course Objectives

This course enables the students to

1. Determine the surface tension of a liquid.
2. Determine the viscosity of a liquid.
3. Distinquish the surface tension of different concentration of detergent solutions.
4. Prepare a buffer solution and to measure its pH.
5. Understand the concepts of diffraction methods.
6. Analyze the pH of a solution during the course of a titration.

Course Outcomes

On the successful completion of this course, the students will be able to

1. Check the surface tension of aliquid.
2. Determine the viscosity of a liquid.
3. Distinquish the surface tension of different concentration of detergent solutions.
4. Determine the pH of a buffer solution.
5. Understand the concepts of diffraction methods.
6. Test the pH of a solution during the course of a titration.

Contents

1. **Surface tension measurements**
   a. Determination of the surface tension of a liquid.
   b. Study the variation of surface tension with different concentration of detergent solutions.

2. **Viscosity measurement.**
   a. Determination of co-efficient of viscosity of an unknown aqueous solution.
   b. Study the variation of co-efficient of viscosity with different concentration of Poly Vinyl Alcohol (PVA) and determine molar of PVA.
   b. Study the variation of viscosity with different concentration of sugar solutions.

3. **Solid State:**
   a. Indexing of a given powder diffraction pattern of a cubic crystalline system.

4. **pH metry**:
   a. Study the effect of addition of HCl/NaOH on pH to the solutions of acetic acid, sodium acetate and their mixtures.
   b. Preparation of buffer solutions of different pH values (i). Sodium acetate-acetic acid (ii).Ammonium chloride-ammonium hydroxide
   c. pH metric titration of (i) strong acid with strong base, (ii) weak acid with strong base.
   d. Determination of dissociation constant of a weak acid.

SUGGESTED READINGS

1. Khosla, B. D., Garg, V. C. & Gulati, A.(2011). *Senior Practical Physical Chemistry.* New Delhi: R. Chand & Co.
2. Garland, C. W., Nibler, J. W. & Shoemaker, D. P. (2003). *Experiments in Physical Chemistry*. 8th Ed. New York: McGraw-Hill.
3. Halpern, A. M. &McBane, G. C. (2003).*Experimental Physical Chemistry*.3rd Ed. New York: W. H. Freeman & Co.

Semester-VI

21CHU691	**PROJECT AND VIVA-VOCE**	**8H 6C**

Instruction Hours/week: L:0 T:0 P:8 **Marks:Internal:40** **External: 60 Total:100**