REGULATIONS AND SYLLABUS

Bachelor of Science (HONOURS) in CHEMISTRY (W.e.f. 2016-17 admitted batch)

Website: www.gitam.edu
B.Sc. (Hons.) CHEMISTRY
REGULATIONS
(W.e.f. 2016-17 admitted batch)

1.0 ADMISSIONS
Admissions into B.Sc. (Hons.) Chemistry program of GITAM University are
governed by GITAM University admission regulations.

2.0 ELIGIBILITY CRITERIA
2.1 A pass in Intermediate with Chemistry as one of the Subject(s) and with a
minimum aggregate of 50% marks or any other equivalent Examination
approved by GITAM University.
2.2 Admissions into B.Sc. (Hons.) CHEMISTRY will be based on the marks
obtained in intermediate or equivalent examination and the rule of
reservation, wherever applicable.

3.0 CHOICE BASED CREDIT SYSTEM
Choice based credit system (CBCS) is introduced with effect from the admitted
batch of 2015-16 based on UGC guidelines in order to promote:
- Student centered learning
- Cafeteria approach
- Inter-disciplinary learning.
Learning goals/objectives and outcomes are specified leading to what a student
should be able to do at the end of the program.

4.0 STRUCTURE OF THE PROGRAMME
4.1 The program consists of:
(i) Ability enhancement compulsory core courses (AECC)
(ii) Core Courses (compulsory) (CC)
(iii) Discipline specific electives (DSE)
(iv) Generic electives (GE)
(v) Skill enhancement courses (SEC) are of general nature either related
or unrelated to the discipline.
(vi) Practical Proficiency Courses: Laboratory work
4.2 Each course is assigned a certain number of credits depending upon the
number of contact hours (lectures/tutorials/practical) per week.
4.3 In general, credits are assigned to the courses based on the following
contact hours per week per semester.
- One credit for each lecture / tutorial hour.
- Two credits for three hours of practicals.
4.4 The curriculum of six semesters B.Sc. (Hons.) CHEMISTRY program is
designed to have a total of 140 credits for the award of B.Sc. (Hons.)
CHEMISTRY degree.
5.0 **MEDIUM OF INSTRUCTION:**

The medium of instruction (including examinations and project reports) shall be English.

6.0 **REGISTRATION**

Every student has to register himself/herself for each semester individually at the time specified by the Institute / University.

7.0 **ATTENDANCE REQUIREMENTS**

7.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the end - semester examination and he/she will not be allowed to register for subsequent semester of study. He /She have to repeat the semester along with his / her juniors.

7.2 However, the Vice Chancellor on the recommendation of the Principal/ Director of the University College / Institute may condone the shortage of attendance to the students whose attendance is between 66% and 74% on genuine medical grounds and on payment of prescribed fee.

8.0 **EVALUATION**

8.1 The assessment of the student’s performance in a Theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end examination (60 marks).

8.2 A student has to secure an aggregate of 40% in the course in the two components put together to be declared to have passed the course, subject to the condition that the candidate must have secured a minimum of 24 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical/ Viva voce/ Seminar etc. course are completely assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table 1.
Table 1: Assessment Procedure

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Component of assessment</th>
<th>Marks allotted</th>
<th>Type of Assessment</th>
<th>Scheme of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Theory</td>
<td>40</td>
<td>Continuous evaluation</td>
<td>(i) Two mid semester examinations shall be conducted for 15 marks each. (ii) 5 marks are allocated for quiz. (iii) 5 marks are allocated for assignments.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Semester-end examination</td>
<td>The semester-end examination shall be for a maximum of 60 marks.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Practicals</td>
<td>40</td>
<td>Continuous evaluation</td>
<td>Forty (40) marks for continuous evaluation is distributed among the components: regularity, preparation for the practical, performance, submission of records and oral presentations in the laboratory. Weightage for each component shall be announced at the beginning of the Semester.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Continuous evaluation</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sixty (60) marks for two tests of 30 marks each (one at the mid-term and the other towards the end of the Semester) conducted by the concerned lab Teacher and another faculty member of the department who is not connected to the lab, as appointed by the HoD.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

9.0 REAPPEARANCE

9.1 A student who has secured ‘F’ grade in a Theory course shall have to reappear at the subsequent semester end examinations held for that course.

9.1.1 A student who has secured ‘F’ grade in a Practical course shall have to attend Special Instruction Classes held during summer.

9.1.2 A student who has secured ‘F’ Grade in Project work / Industrial Training etc shall have to improve his/her report and reappear for Viva – voce at the time of Special Examination to be conducted in the summer vacation.

10.0 SPECIAL EXAMINATION

A student who has completed his/her period of study and still has “F” grade in a maximum of three Theory courses is eligible to appear for Special Examination normally held during summer vacation.

11.0 BETTERMENT OF GRADES

A student who has secured only a Pass or Second class and desires to improve his/her Class can appear for Betterment Examinations only in Theory courses of any Semester of his/her choice, conducted in Summer Vacation along with the Special Examinations. Betterment of Grades is permitted ‘only once’ immediately after completion of the program of study.
12.0 GRADING SYSTEM

12.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table-2.

**Table 2: Grades & Grade Points**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Grade</th>
<th>Grade Points</th>
<th>Absolute Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>O (outstanding)</td>
<td>10</td>
<td>90 and above</td>
</tr>
<tr>
<td>2</td>
<td>A+ (Excellent)</td>
<td>9</td>
<td>80 to 89</td>
</tr>
<tr>
<td>3</td>
<td>A (Very Good)</td>
<td>8</td>
<td>70 to 79</td>
</tr>
<tr>
<td>4</td>
<td>B+ (Good)</td>
<td>7</td>
<td>60 to 69</td>
</tr>
<tr>
<td>5</td>
<td>B (Above Average)</td>
<td>6</td>
<td>50 to 59</td>
</tr>
<tr>
<td>6</td>
<td>C (Average)</td>
<td>5</td>
<td>45 to 49</td>
</tr>
<tr>
<td>7</td>
<td>P (Pass)</td>
<td>4</td>
<td>40 to 44</td>
</tr>
<tr>
<td>8</td>
<td>F (Fail)</td>
<td>0</td>
<td>Less than 40</td>
</tr>
<tr>
<td>9</td>
<td>Ab. (Absent)</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

12.2 “A student who earns a minimum of four grade points (P Grade) in a Course is declared to have successfully completed the course, subject to securing an average GPA (average of all GPAs in all the semesters) of 5 at the end of the Program to declare pass in the program”. “Candidates who could not secure an average GPA of 5 at the end of the program shall be permitted to reappear for a course(s) of their choice to secure the same”.

13.0 GRADE POINT AVERAGE

13.1 A Grade Point Average (GPA) for the semester/trimester will be calculated according to the formula:

\[
\text{GPA} = \frac{\sum [C \times G]}{\sum C}
\]

Where

- C = number of credits for the course,
- G = grade points obtained by the student in the course.

13.2 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student’s performance in all the courses taken, in all the semesters up to the particular point of time.

13.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.
Table 3: CGPA required for award of Class

<table>
<thead>
<tr>
<th>Class</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinction</td>
<td>≥ 8.0*</td>
</tr>
<tr>
<td>First Class</td>
<td>≥ 7.0</td>
</tr>
<tr>
<td>Second Class</td>
<td>≥ 6.0</td>
</tr>
<tr>
<td>Pass</td>
<td>≥ 5.0</td>
</tr>
</tbody>
</table>

* In addition to the required CGPA of 8.0, the student must have necessarily passed all the courses of every semester in first attempt.

14.0 ELIGIBILITY FOR AWARD OF THE B.Sc. DEGREE

14.1 Duration of the program: A student is ordinarily expected to complete B.Sc. program in six semesters of three years. However a student may complete the program in not more than five years including study period.

14.2 However the above regulation may be relaxed by the Vice Chancellor in individual cases for cogent and sufficient reasons.

14.3 A student shall be eligible for award of the B.Sc Degree if he / she fulfills all the following conditions.

a) Registered and successfully completed all the courses and projects.

b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.

c) Has no dues to the Institute, hostels, Libraries, NCC / NSS etc, and

d) No disciplinary action is pending against him / her.

14.4 The degree shall be awarded after approval by the Academic Council

15.0 Discretionary Power:

Notwithstanding anything contained in the above sections, the Vice Chancellor may review all exceptional cases, and give his decision, which will be final and binding.
**Course Structure (Chemistry-Major)**

**Details of courses under B.Sc. (Honours)**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>*CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Core Course Theory (14 Papers)</td>
<td>14×4 = 56</td>
</tr>
<tr>
<td>Core Course Practical / Tutorial* (14 Papers)</td>
<td>14×2 = 28</td>
</tr>
<tr>
<td>II. Elective Course (8 Papers)</td>
<td></td>
</tr>
<tr>
<td>A.1. Discipline Specific Elective (4 Papers)</td>
<td>4×4 = 16</td>
</tr>
<tr>
<td>A.2. Discipline Specific Elective Practical/Tutorial* (4 Papers)</td>
<td>4×2 = 8</td>
</tr>
<tr>
<td>B.1. Generic Elective/ Interdisciplinary (4 Papers)</td>
<td>4×4 = 16</td>
</tr>
<tr>
<td>B.2. Generic Elective Practical/ Tutorial* (4 Papers)</td>
<td>4×2 = 8</td>
</tr>
</tbody>
</table>

**III. Ability Enhancement Courses**

1. **Ability Enhancement Compulsory** (2 Papers of 2 credit each)
   - Environmental Science
   - English/MIL Communication
   | 2×2 = 4 |

2. **Ability Enhancement Elective** (Skill Based) (Minimum 2)
   - (2 Papers of 2 credit each)
   | 2×2 = 4 |

**Total credit** | 140 |

* wherever there is a practical there will be no tutorial and vice-versa
# STRUCTURE OF B.Sc. (HONS.) CHEMISTRY PROGRAM

## SEMESTER -1

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Category</th>
<th>Title</th>
<th>Periods / week</th>
<th>Credits</th>
<th>Scheme of Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFC 101</td>
<td>AECC</td>
<td>English Communication skills</td>
<td>3</td>
<td>2</td>
<td>CE 40 SE 60 Total 100</td>
</tr>
<tr>
<td>SCY 101</td>
<td>CC</td>
<td>Inorganic Chemistry I: Atomic Structure &amp; Chemical Bonding</td>
<td>4</td>
<td>4</td>
<td>CE 40 SE 60 Total 100</td>
</tr>
<tr>
<td>SCY 103</td>
<td>CC</td>
<td>Physical Chemistry I: States of Matter &amp; Ionic Equilibrium</td>
<td>4</td>
<td>4</td>
<td>CE 40 SE 60 Total 100</td>
</tr>
<tr>
<td>SCY 105</td>
<td>GE</td>
<td>Mathematics for Science</td>
<td>4</td>
<td>4</td>
<td>CE 40 SE 60 Total 100</td>
</tr>
<tr>
<td>SCY 121</td>
<td>PPC</td>
<td>Inorganic Chemistry -I Lab</td>
<td>3</td>
<td>2</td>
<td>CE 100 SE -- Total 100</td>
</tr>
<tr>
<td>SCY 123</td>
<td>PPC</td>
<td>Physical Chemistry -I Lab</td>
<td>3</td>
<td>2</td>
<td>CE 100 SE -- Total 100</td>
</tr>
<tr>
<td>SCY 125</td>
<td>PPC</td>
<td>Mathematics for science Tutorials</td>
<td>2</td>
<td>2</td>
<td>CE 100 SE -- Total 100</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Total</th>
<th>Periods</th>
<th>Credits</th>
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## SEMESTER -2

<table>
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<tr>
<th>Course Code</th>
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<th>Periods / week</th>
<th>Credits</th>
<th>Scheme of Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFC 102</td>
<td>AECC</td>
<td>Environmental science</td>
<td>3</td>
<td>2</td>
<td>CE 40 SE 60 Total 100</td>
</tr>
<tr>
<td>SCY 102</td>
<td>CC</td>
<td>Organic Chemistry- I: Basics and Hydrocarbons</td>
<td>4</td>
<td>4</td>
<td>CE 40 SE 60 Total 100</td>
</tr>
<tr>
<td>SCY 104</td>
<td>CC</td>
<td>Physical Chemistry-II: Chemical Thermodynamics and its Applications</td>
<td>4</td>
<td>4</td>
<td>CE 40 SE 60 Total 100</td>
</tr>
<tr>
<td>SCY 106</td>
<td>GE</td>
<td>Physics –I:Applied Physics</td>
<td>4</td>
<td>4</td>
<td>CE 40 SE 60 Total 100</td>
</tr>
<tr>
<td>SCY 120</td>
<td>PPC</td>
<td>Organic Chemistry -I Lab</td>
<td>3</td>
<td>2</td>
<td>CE 100 SE -- Total 100</td>
</tr>
<tr>
<td>SCY 122</td>
<td>PPC</td>
<td>Physical Chemistry -II Lab</td>
<td>3</td>
<td>2</td>
<td>CE 100 SE -- Total 100</td>
</tr>
<tr>
<td>SCY 124</td>
<td>PPC</td>
<td>Applied Physics Lab</td>
<td>3</td>
<td>2</td>
<td>CE 100 SE -- Total 100</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Total</th>
<th>Periods</th>
<th>Credits</th>
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<td>20</td>
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### SEMESTER -3

<table>
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<th>Periods /week</th>
<th>Credits</th>
<th>Scheme of Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCY 201</td>
<td>CC</td>
<td>Inorganic Chemistry II: s- and p-Block Elements</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 203</td>
<td>CC</td>
<td>Organic Chemistry II: Oxygen Containing Functional Groups</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 205</td>
<td>GE</td>
<td>Physics-II: Mechatronics-1</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY XXX</td>
<td>DSE</td>
<td>DSE-1 (SCY 241/243)</td>
<td>4</td>
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<td>40 60 100</td>
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<tr>
<td>SSE XXX</td>
<td>SEC</td>
<td>SEC-1 (SSE 251/253)</td>
<td>2</td>
<td>2</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 221</td>
<td>PPC</td>
<td>Inorganic Chemistry II Lab</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td>SCY 223</td>
<td>PPC</td>
<td>Organic Chemistry II Lab</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td>SCY 225</td>
<td>PPC</td>
<td>Physics-II(Mechatronics-1) Lab</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td>SCY XXX</td>
<td>PPC</td>
<td>DSE -1 Lab (SCY 227/229)#</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
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<td>Total</td>
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### SEMESTER -4

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<tr>
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<th>Periods /week</th>
<th>Credits</th>
<th>Scheme of Evaluation</th>
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<tbody>
<tr>
<td>SCY 202</td>
<td>CC</td>
<td>Organic Chemistry III: Heterocyclic Chemistry</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 204</td>
<td>CC</td>
<td>Physical Chemistry III: Phase Equilibria and Chemical Kinetics</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 206</td>
<td>GE</td>
<td>Physics-III: Mechatronics-2</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY XXX</td>
<td>DSE</td>
<td>DSE-2 (DSE 242/244/246)</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SSE XXX</td>
<td>SEC</td>
<td>SEC-2 (SSE 252/254)</td>
<td>2</td>
<td>2</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 220</td>
<td>PPC</td>
<td>Organic Chemistry III Lab</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td>SCY 222</td>
<td>PPC</td>
<td>Physical Chemistry III Lab</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td>SCY 224</td>
<td>PPC</td>
<td>Physics-III(Mechatronics-2) Lab</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td>SCY XXX</td>
<td>PPC</td>
<td>DSE-2 Lab (SCY 226/228)#</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>30</td>
<td>26</td>
<td></td>
</tr>
</tbody>
</table>

# This Laboratory should be taken in coherence with discipline specific elective (DSE)
### SEMESTER- 5

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Category</th>
<th>Title</th>
<th>Periods /week</th>
<th>Credits</th>
<th>Scheme of Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCY 301</td>
<td>CC</td>
<td>Inorganic Chemistry III: Coordination Chemistry</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 303</td>
<td>CC</td>
<td>Organic Chemistry IV: Biomolecules</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 305</td>
<td>CC</td>
<td>Physical Chemistry IV: Electrochemistry</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY XXX</td>
<td>DSE</td>
<td>DSE-3 (DSE 341/343)</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 321</td>
<td>PPC</td>
<td>Inorganic Chemistry III Lab</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td>SCY 323</td>
<td>PPC</td>
<td>Organic Chemistry IV Lab</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td>SCY 325</td>
<td>PPC</td>
<td>Physical Chemistry IV Lab</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
</tr>
<tr>
<td>SCY XXX</td>
<td>PPC</td>
<td>DSE-3 Lab (DSE-3 Lab)</td>
<td>3</td>
<td>2</td>
<td>100 -- 100</td>
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| Total       |          |                                            |               |         | 28 24                |

### SEMESTER -6

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Category</th>
<th>Title</th>
<th>Periods /week</th>
<th>Credits</th>
<th>Scheme of Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCY 302</td>
<td>CC</td>
<td>Inorganic Chemistry IV: Organometallic Chemistry</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 304</td>
<td>CC</td>
<td>Organic Chemistry V: Spectroscopy</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY 306</td>
<td>CC</td>
<td>Physical Chemistry V: Quantum Chemistry &amp; Spectroscopy</td>
<td>4</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>SCY XXX</td>
<td>DSE</td>
<td>DSE-4 (DSE342/344)</td>
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<td>SCY 320</td>
<td>PPC</td>
<td>Inorganic Chemistry IV Lab</td>
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<td>SCY 322</td>
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<td>Organic Chemistry V Lab</td>
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<tr>
<td>SCY 324</td>
<td>PPC</td>
<td>Physical Chemistry V Lab</td>
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<td>PPC</td>
<td>DSE-4 Lab (SCY 326/328)#</td>
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</tr>
</tbody>
</table>

| Total       |          |                                            |               |         | 28 24                |

# This Laboratory should be taken in coherence with discipline specific elective (DSE)
Discipline Specific Electives (DSE)

**DSE – 1 (One paper to be selected)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCY 241</td>
<td>Analytical Methods in Chemistry</td>
</tr>
<tr>
<td>SCY 243</td>
<td>Anatomy, Physiology and pharmacology</td>
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**DSE – 2 (One paper to be selected)**

<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>SCY 242</td>
<td>Basic Concepts of Medicinal Chemistry</td>
</tr>
<tr>
<td>SCY 244</td>
<td>Fundamentals of Instrumental Methods of Analysis</td>
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<td>SCY 246</td>
<td>Green Chemistry</td>
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**DSE – 3 (One paper to be selected)**

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<tr>
<td>SCY 341</td>
<td>Pharmaceutics – 1</td>
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<td>SCY 343</td>
<td>Unit Operations in Chemical Engineering</td>
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**DSE – 4 (One paper to be selected)**

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<tbody>
<tr>
<td>SCY 342</td>
<td>Pharmaceutics -2</td>
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<tr>
<td>SCY 344</td>
<td>Industrial Chemicals &amp; Environment</td>
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SKILL ENHANCEMENT COURSES

**SEC -1 (One paper to be selected)**

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<th>Course Code</th>
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<tr>
<td>SSE 251</td>
<td>Intellectual Property Rights</td>
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<tr>
<td>SSE 253</td>
<td>Regulatory Affairs &amp; Quality Assurance</td>
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**SEC -2 (One paper to be selected)**

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<th>Course Code</th>
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<tbody>
<tr>
<td>SSE 252</td>
<td>Industrial Safety</td>
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<td>SSE 254</td>
<td>Chemical Technology &amp; Society</td>
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<table>
<thead>
<tr>
<th>Type of Course</th>
<th>No. of courses</th>
<th>Credits</th>
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<tbody>
<tr>
<td></td>
<td>Theory</td>
<td>Lab/Tutorial</td>
</tr>
<tr>
<td>Ability Enhancement Compulsory Courses</td>
<td>2</td>
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<td>Core courses</td>
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<td>Skill enhancement Courses</td>
<td>02</td>
<td>--</td>
</tr>
<tr>
<td>TOTAL</td>
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TOTAL CREDITS: 140 (Theory: 97 and Lab: 43)
SEMESTER -1

SFC 101: ENGLISH COMMUNICATION SKILLS (AECC)

Hours per week: 3  
Credits: 2

Semester End Examination: 60 Marks  
Continuous Evaluation: 40 marks

UNIT-I  
Textual Lessons 1 & 2  
Synonyms & Antonyms, One word substitutes, 
Words often confused, Phrasal Verbs

UNIT-II  
Textual Lesson – 3  
Foreign Phrases, Tenses, Concord

UNIT-III  
Textual Lesson - 4  
Error Analysis, Single Sentence Definition, Paragraph Writing

UNIT-IV  
Textual Lesson - 5  
Essay Writing, Dialogue Writing, Reading Comprehension

UNIT-V  
Textual Lesson – 6  
Note Making, Precis Writing

Text Books:
Part – 1 (Communicate Units 1 to 6 only) of Creative English for Communication, N.Krishna Swamy & T. Sriraman.Macmillan India Ltd (2005 version)

Supplementary Reading:
Current English for Colleges., N. Krishna Swamy & T. Sri Raman.  
Macmillan. Examine your English Margaret Maison,Macmillan.

SCY 101: INORGANIC CHEMISTRY I - ATOMIC STRUCTURE & CHEMICAL BONDING (CC)

Hours per week: 4  
Credits: 4

Semester End Examination: 60 Marks  
Continuous Evaluation: 40 marks

Unit-I: Atomic Structure


Unit-II: Periodicity of $s$, $p$, $d$- block elements
$s$, $p$, $d$, block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to $s$ and $p$-block.
(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
(b) Atomic radii (van der Waals)
(c) Ionic and crystal radii.
(d) Covalent radii (octahedral and tetrahedral)
(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.
(f) Electronegativity, Pauling’s/ Mulliken’s/lectronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization.

Unit-III: Periodicity of f-block elements
f-block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block
(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table, (b)Atomic radii (van der Waals), (c) Ionic and crystal radii, (d) Covalent radii (octahedral and tetrahedral) (e) Electronegativity

Chemical bonding-1
Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

Unit-IV: Chemical bonding-2
(i) Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent’s rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N2, O2, C2, B2, F2, CO, NO, and their ions; HCl, BeF2, CO2, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths.
Covalent character in ionic compounds, polarizing power and polarizability. Fajan’s rules and consequences of polarization.
Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

Unit-V: Chemical bonding-3
(iii) Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

(iv) Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions,. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment)

Reference Books:
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, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure.

Molecular velocities (average, root mean square and most probable) and average kinetic energy.

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases. Causes of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behavior.

UNIT-II: Liquid state

Qualitative treatment of the structure of the liquid state; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Temperature variation of viscosity of liquids. Qualitative discussion of structure of water.

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, powder pattern method.

UNIT-IV: Ionic equilibria-1

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect.

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions- derivation of Henderson equation and its applications; and applications of buffers in analytical chemistry.

UNIT-V: Ionic equilibria-2


Reference Books:

SCY 105: MATHEMATICS FOR SCIENCE (GE)

Hours per week: 4  Semester End Examination: 60 Marks
Credits: 4          Continuous Evaluation: 40 marks

UNIT –I:
Differentiation: Derivative of a function, Derivatives of some standard functions, Derivatives of trigonometric functions, Derivatives of composite functions, Derivatives of inverse functions, Derivatives of inverse trigonometric functions, Hyperbolic functions, Derivatives of Hyperbolic functions, Derivatives of inverse Hyperbolic functions, Implicit differentiation, Logarithmic differentiation

UNIT –II:
Indefinite Integration: Indefinite integral, Methods of integration, Integration by substitution, Integration of some standard functions, Integration by parts, Definite integrals, Properties of definite integrals

UNIT –III:

UNIT –IV:
Matrices: Definition, Addition and multiplication of matrices, Various types of matrices, Determinant of a square matrix, Crammer's rule, Inverse of matrix, Solution of system of linear equations by matrix inversion method.

UNIT –V:
Statistical methods: Introduction, Collection and classification of data, Graphical representation, Measures of central tendency (Mean, Median & Mode), Measures of dispersion.

Text Books:
3. Higher engineering Mathematics by Dr. B.S.Grewal, Khanna publishers

SCY 121 INORGANIC CHEMISTRY -I LAB (CC/PPC)

Hours per week: 3  Credits: 2          Continuous Evaluation: 100 marks

(A) Titrimetric Analysis
   (i) Calibration and use of apparatus
   (ii) Preparation of solutions of different Molarity/Normality of titrants

(B) Acid-Base Titrations
   (i) Estimation of carbonate and hydroxide present together in mixture.
   (ii) Estimation of carbonate and bicarbonate present together in a mixture.
(C) Oxidation-Reduction Titrimetry

(i) Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution.
(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.
(iii) Estimation of Fe(II) with K2Cr2O7 using internal external (diphenylamine, anthranilic acid) and external indicator.

Reference text:


SCY 123: PHYSICAL CHEMISTRY -I LAB (CC/PPC)

Hours per week: 3 Credits: 2 Continuous Evaluation: 100 marks

1. Surface tension measurements.
   Determination of the surface tension by drop number method.

2. Viscosity measurement using Ostwald’s viscometer.
   Determination of viscosity of aqueous solutions of (i) ethanol and (ii) sugar at room temperature.

3. Indexing of a given powder diffraction pattern of a cubic crystalline system.

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

Reference Books


SCY 125: MATHEMATICS FOR SCIENCE TUTORIALS (CC/PPC)

Hours per week: 2 Credits: 2 Continuous Evaluation: 100 marks
SEMESTER II

SFC 102: ENVIRONMENTAL SCIENCE (AECC)

Hours per week: 3  Semester End Examination: 60 Marks
Credits: 2  Continuous Evaluation: 40 marks

UNIT-I
The Multidisciplinary nature of environmental studies–Definition, Scope and Importance, Need for Public awareness. Natural Resources: Classification – Renewable and Non Renewable Resources. Renewable Resources: Forest, Water and Energy Resources Non Renewable Resources: Mineral, Food and Land resources (Uses, reasons for over-utilization and effects)

UNIT-II
Eco-system: Structure of an Ecosystem, Producers, consumers and de-composers. Structure of Terrestrial Ecosystems (Forest ecosystem, Grassland ecosystem and Desert ecosystem) and Aquatic Ecosystems (Pond ecosystem and ocean ecosystem). Function of an ecosystem -food chains, food web and ecological pyramids - energy flow in the ecosystem. Environmental Pollution: Causes, effects and control measures of Air, Water, soil pollution, Thermal pollution and nuclear hazards. Municipal solid waste management.

UNIT-III
Environmental problems: Global Environmental Problems, Green house effect, Ozone layer depletion, acid rains and Climate change. National Environmental Problems: Deforestation – Causes and Effects, Environmental Problems associated with dams. Mining and Environmental effects.

UNIT-IV

UNIT-V

Text Books:
1. Text Book of Environmental studies for Undergraduate courses by Bharucha Erach Published by V.G.C
2. Environmental Science: A Global Concern by William P.Cunningham and Baraba Woodworth Saigo.
3. A text book of Environmental Science by P.C.Joshi
4. A text book of Environmental Science by Arvind Kumar
5. A text book of Environmental Science by S.C.Santra
6. Ecology & Environment by P.D.Sharma
SCY 102: ORGANIC CHEMISTRY I - BASICS AND HYDROCARBONS (CC)

Hours per week: 4  
Semester End Examination: 60 Marks
Credits: 4  
Continuous Evaluation: 40 marks

Unit-I: Basics of Organic Chemistry

*Organic Compounds*: Classification, and Nomenclature, Hybridization.

*Electronic Displacements*: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation; Dipole moment.

Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles; Nucleophilicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes.

Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions (only Basics).

**UNIT-II: Stereochemistry**:

Fischer Projection, Newmann and Sawhorse Projection formulae; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations.

*Optical Isomerism*: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

**UNIT-III: Chemistry of Aliphatic Hydrocarbons-1**

Carbon-Carbon sigma bonds


Carbon-Carbon pi bonds:

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

**UNIT-IV Chemistry of Aliphatic Hydrocarbons-2**

*Reactions of alkenes*: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction.

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

*Cycloalkanes and Conformational Analysis*

Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms;
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 the groups.

**Reference Books:**

**SCY 104: PHYSICAL CHEMISTRY II - CHEMICAL THERMODYNAMICS AND ITS APPLICATIONS (CC)**

- Hours per week: 4
- Credits: 4
- Semester End Examination: 60 Marks
- Continuous Evaluation: 40 marks

**Unit-I: Chemical Thermodynamics -1**
Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.
*First law:* Concept of heat, \( q \), work, \( w \), internal energy, \( U \), and statement of first law; enthalpy, \( H \), relation between heat capacities (ideal) under isothermal and adiabatic conditions.

**Unit-II: Chemical Thermodynamics -2**
*Thermochemistry:* Heats of reactions: standard states; enthalpy of formation of molecules and ions; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data.
*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: Chemical Thermodynamics -3**
*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. Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

**Unit-IV: Chemical Equilibrium:**
Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants \( K_p \), \( K_c \) and \( K_x \). Le Chatelier principle (quantitative treatment);

**Unit-V: Solutions and Colligative Properties:**
Dilute solutions; lowering of vapour pressure, Raoult’s and Henry’s Laws and their applications.
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.

**Reference Books**


**SCY 106: PHYSICS I - APPLIED PHYSICS (GE)**

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<tr>
<th>Hours per week: 4</th>
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<tbody>
<tr>
<td>Credits: 4</td>
<td>Continuous Evaluation: 40 marks</td>
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**UNIT –I: Measurements**

Physical quantities-standards and units-International systems of units-the standard of time-the standard length-the standard mass precession and significant figures.
Dimensional Homogeneity and Consistency-Dimensional analysis-Dimensionless groups and their use in chemical engineering-National Standards of Weights-Measurements & their calibration.

**UNIT –II: Mechanics**


**UNIT –III: Wave nature of light and Optical fibers**

Introduction-Nature of light-Reflection and refraction-Total internal reflection- Definition and properties of wave front and ray - Huygens principle- Mathematical representation of plane wave-General wave equation-Optical Fibers-Numerical aperture- Acceptance angle-Step and Graded Indices (Concept and definitions only). Single and Multiple mode fibers (Concept and definition Only)-Applications of optical fibers

**UNIT –IV: Waves-Interference and Diffraction**

Division of amplitude and wave front-Young’s double slit experiment-Phase change on reflection- Stokes’ treatment-Interference in Thin films-parallel and wedge-shaped films-Fringes of equal inclination (Haidinger fringes). Newton’s Rings: Measurement of wavelength and refractive index. Diffraction-types of diffraction-Diffraction grating and resolving power.

**UNIT –V: LASER**


**Text Books**

1. Physics-D.Resnick and R.Halliday, Wiely Publishers
2. Text book of Engineering Physics-Dr. M N Avadhanulu & Dr.P G Kshirsagar, S Chand & Co Pvt Ltd, New Delhi
3. Optics-Brijlal Subrahmanyam, S Chand Co
SCY 120: ORGANIC CHEMISTRY -I LAB (CC/PPC)

Hours per week: 3  Credits: 2  Continuous Evaluation: 100 marks

1. Checking the calibration of the 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 above compounds and unknown organic compounds
4. Determination of boiling point of liquid compounds.
5. Chromatography
   a. Separation of a mixture of two amino acids by ascending and horizontal 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)

Reference Books

SCY 122: PHYSICAL CHEMISTRY -II LAB (CC/PPC)

Hours per week: 3  Credits: 2  Continuous Evaluation: 100 marks

1. Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
2. Calculation of the enthalpy of ionization of ethanoic acid.
3. Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
4. Determination of basicity/proticity of a polyprotic 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 first step.
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of $\Delta H$.

Reference Books
SCY 124: APPLIED PHYSICS LAB (CC/PPC)

Hours per week: 3    Credits: 2    Continuous Evaluation: 100 marks

List of experiments:
1. Determination of thickness of wire by using Screw guage
2. Determination of volume of the cylinder or sphere by using Vernier calipers
3. Radius of curvature of curved surface using Spherometer
4. Determination of time period of Simple pendulum
5. Determination of Numerical aperture/Loss of Optical fiber
6. Determination of wavelength of LASER using grating
7. Determination of wavelength of monochromatic light with Newton’s rings
8. Diffraction due to single slit/circular aperture
9. Study of characteristics of LASER
SEMESTER III

SCY 201: INORGANIC CHEMISTRY II – S & P-BLOCK ELEMENTS (CC)

Hours per week: 4  
Semester End Examination: 60 Marks
Credits: 4  
Continuous Evaluation: 40 marks

Unit-I: General Principles of Metallurgy

Acids and Bases

Unit-II: Chemistry of s Block Elements
Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s block elements.
Hydrides and their classification ionic, covalent and interstitial.

Unit-III: Chemistry of p Block Elements
Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of p block elements.
Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate.
Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses.
Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds.

Unit-IV: Noble Gases
Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF2, XeF4 and XeF6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF2).

Unit-V: Inorganic Polymers
Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.

Reference Books:
SCY203: ORGANIC CHEMISTRY II - OXYGEN CONTAINING FUNCTIONAL GROUPS (CC)

Hours per week: 4  Semester End Examination:  60 Marks
Credits: 4  Continuous Evaluation:  40 marks

UNIT I: Chemistry of Halogenated Hydrocarbons:
Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent;
Aryl halides: Preparation, including preparation from diazonium salts, nucleophilic aromatic substitution; SNAr, Benzyne mechanism.
Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

UNIT II: Alcohols, Phenols, Ethers and Epoxides:
Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement;
Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe’s–Schmidt Reactions, with mechanism.

UNIT III: Carbonyl Compounds:
Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Cannizzaro and Wittig reaction, Beckmann rearrangements, haloform reaction and Baeyer Villiger oxidation.
Addition reactions of unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-enol tautomerism.

UNIT IV: Carboxylic Acids
Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic, lactic, maleic, tartaric, citric, maleic and fumaric acids;

UNIT V: Carboxylic Acids Derivatives
Preparation and reactions of acid chlorides, anhydrides, esters and amides; -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions.

Reference Books:
- Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

SCY 205: PHYSICS II - MECHATRONICS-I (CC)

Hours per week: 4  Semester End Examination:  60 Marks
Credits: 4  Continuous Evaluation:  40 marks

UNIT I: Concepts of Electrical Energy
Electric current-Electric potential-potential difference-maintaining potential difference-concept of emf and potential difference resistance-factors upon which resistance depend-resistivity conductivity-effect of temperature on resistance-temperature coefficient of resistance-temperature coefficients relations-Ohm’s law-electrical power and electric energy.
UNIT –II: Sources of Electrical energy
Cells-types of cells-lead acid cell-chemical changes during discharging-chemical changes during recharging-construction of lead acid battery-characteristics-indications of fully charged cell-care of lead acid batteries and applications. D.C Motor principle-working-back emf-significance of back emf-voltage equation power equation-power equation-condition for maximum power and applications.

UNIT –III: Electrical power
Structure of electrical power system-electrical supply system-typical A.C power supply scheme-types of power plants-variable loads on power plants-base load and peak load on power station-method of meeting load-transmission of electrical energy-Distribution of electrical energy-systems and classification.

UNIT –IV: Basic Electronics
Semiconductor devices-diodes-Bipolar junction transistor-field effect transistor their structure symbol and characteristics.
Rectifiers-Classification-circuit diagrams-comparison-efficiency-ripple factor and nature of output of half and full wave rectifiers. Filters circuits-types of filter circuits

UNIT –V: Measurement, instrumentation and calibration

Text Books
3. Transducers and Instrumentation D.V.S.murthy,PHI(2nd Ed).

SCY 241: ANALYTICAL METHODS IN CHEMISTRY (DSE)

Hours per week: 4
Credits: 4
Semester End Examination: 60 Marks
Continuous Evaluation: 40 marks

Unit -I: Qualitative and quantitative aspects of analysis:
Evaluation of analytical data, errors, accuracy and precision, methods of their expression,, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Optical methods of analysis:

UNIT –II:
UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument;
Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument;

UNIT –III:
Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; sources of chemical interferences. Techniques for the quantitative estimation of trace level of metal ions from water samples.
Electroanalytical methods: Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations.

UNIT –V: Separation techniques:

Reference Books:

SCY 243: ANATOMY, PHYSIOLOGY AND PHARMACOLOGY (DSE)

Hours per week: 4  
Semester End Examination: 60 Marks
Credits: 4  
Continuous Evaluation: 40 marks

UNIT –I: Scope of Anatomy and physiology. Definition of various terms used in Anatomy. Structure of cell, function of its components
Elementary tissues: Elementary tissues of the body, i.e. epithelial tissue, muscular tissue, connective tissue and nervous tissue.
Muscular System: Structure of skeletal muscle, physiology of muscle contraction. Names, positions, attachments and functions of various skeletal muscles. physiology of neuromuscular junction.

Respiratory system: Various parts of respiratory system and their functions, physiology of respiration.

Sensory Organs: Elementary knowledge of structure and functions of the organs of taste, smell, ear, eye and skin. Physiology of pain.

Digestive System: names of various parts of digestive system and their functions. structure and functions of liver, physiology of digestion and absorption.

Endocrine System: Endocrine glands and Hormones. Location of glands, their hormones and functions. pituitary, thyroid. Adrenal and pancreas

UNIT –IV: General pharmacology
Definition and sources of drug, Routes of drug administration, their advantages and disadvantages, Pharmacokinetics and Biopharmaceutices - absorption, distribution, metabolism and excretion of drug, Adverse drug reactions, Manifestations of Adverse drug reactions

UNIT –V: Classification and therapeutic uses of the following: Analgesic, antipyretic and non steroidal anti inflammatory drugs (NSAIDS), Local anesthetics , Sedative and hypnotics , Anti epileptics

Recommended Books:

SSE 251: INTELLECTUAL PROPERTY RIGHTS (IPR) (SEC)

Hours per week: 2 Semester End Examination: 60 Marks
Credits: 2 Continuous Evaluation: 40 marks

Introduction to Intellectual Property:
Historical Perspective, Different Types of IP, Importance of protecting IP.

Copyrights
Introduction, How to obtain, Differences from Patents.

Patents
Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

Geographical Indications
Definition, rules for registration, prevention of illegal exploitation, importance to India.

Trade Secrets
Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.
Different International agreements
(a) Word Trade Organization (WTO):
(i) General Agreement on Tariffs & Trade (GATT)
(ii) Trade Related Intellectual Property Rights (TRIPS) agreement
(iii) Madrid Protocol
(iv) Berne Convention
(v) Budapest Treaty

(b) Paris Convention
WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity

Reference Books:

**SSE 253: REGULATORY AFFAIRS AND QUALITY ASSURANCE (SEC)**

Hours per week: 2
Credits: 2
Semester End Examination: 60 Marks
Continuous Evaluation: 40 marks

1. Guidelines for Drug Master File: Types
2. Introduction to ICH
3. Abbreviated New Drug Application (ANDA): Hatch – Waxman amendment, patent term restoration, types of ANDA
4. Manufacturing premises
5. Equipment and Raw Materials
6. Manufacture and QC of Dosage Forms
7. Quality audit of Manufacturing process and facilities
8. Quality Control in Laboratory
9. Validation of Analytical Methods
10. Regulatory considerations in Validation
11. Validation
12. Process Validation
14. Drug Approval
SCY 221: INORGANIC CHEMISTRY -II LAB (CC/PPC)

Hours per week: 3  Credits: 2  Continuous Evaluation: 100 marks

(A) Iodo / Iodimetric Titrations

(i) Estimation of Cu(II) and K2Cr2O7 using sodium thiosulphate solution (Iodimetrically).

(ii) Estimation of available chlorine in bleaching powder iodometrically.

(B) Inorganic preparations

(i) Cuprous Chloride, Cu2Cl2
(ii) Preparation of Manganese(III) phosphate, MnPO4.H2O
(iii) Preparation of Aluminium potassium sulphate KAl(SO4)2.12H2O (Potash alum) or Chrome alum.

Reference Books:


SCY 223: ORGANIC CHEMISTRY -II LAB (CC/PPC)

Hours per week: 3  Credits: 2  Continuous Evaluation: 100 marks

1. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.
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 conventional method.
      b. Using green approach
   ii. Benzoylation 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. Bromination of any one of the following:
      a. Acetanilide by conventional methods
      b. Acetanilide using green approach (Bromate-bromide method)
   iv. Nitration of any one of the following:
      a. Acetanilide/nitrobenzene by conventional method
      b. Salicylic acid by green approach (using ceric ammonium nitrate).
   v. Selective reduction of meta dinitrobenzene to m-nitroaniline.
   vi. Reduction of p-nitrobenzaldehyde by sodium borohydride.
   vii. Hydrolysis of amides and esters.
   ix. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
   x. 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, melting point and TLC.
Reference Books

**SCY 225: PHYSICS-II - MECHATRONICS-1 LAB (GE/PPC)**

Hours per week: 3  Credits: 2  Continuous Evaluation: 100 marks

**List of Experiments:**
1. Verification of Ohm’s law of conductor.
2. AC through Resistance, inductance and capacitance.
3. LCR circuit series/parallel resonance, Q factor.
4. LCR circuits in series and parallel.
5. Half wave rectifier and full wave rectifier.
7. Characteristics of Bipolar junction transistor.
8. Calibration of voltmeter and ammeter.
9. Low pass and high pass filters

**SCY227: ANALYTICAL METHODS IN CHEMISTRYLAB (DSE/PPC)**

Hours per week: 3  Credits: 2  Continuous Evaluation: 100 marks

**I. Separation Techniques**

1. Chromatography:
   (a) Separation of mixtures
      (i) Paper chromatographic separation of Fe$^{3+}$, Al$^{3+}$, and Cr$^{3+}$.
      (ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.
   (b) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their Rf values.
   (c) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

**II. Solvent Extractions:**

(i) To separate a mixture of Ni$^{2+}$ & Fe$^{2+}$ by complexation with DMG and extracting the Ni$^{2+}$-DMG complex in chloroform, and determine its concentration by spectrophotometry.
(ii) Solvent extraction of zisconium with amberliti LA-1, separation from a mixture of irons and gallium.
3. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.
4. Determination of Na, Ca, Li in cola drinks and fruit juices using fame photometric techniques.
5. Analysis of soil:
   (i) Determination of pH of soil.
   (ii) Total soluble salt
   (iii) Estimation of calcium, magnesium, phosphate, nitrate

6. Ion exchange:
   (i) Determination of exchange capacity of cation exchange resins and anion exchange resins.
   (ii) Separation of metal ions from their binary mixture.
   (iii) Separation of amino acids from organic acids by ion exchange chromatography.

III Spectrophotometry
1. Determination of pKa values of indicator using spectrophotometry.
2. Structural characterization of compounds by infrared spectroscopy.
3. Determination of dissolved oxygen in water.
4. Determination of chemical oxygen demand (COD).
5. Determination of Biological oxygen demand (BOD).
6. Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job’s method.

Reference Books:

SCY 229: ANATOMY, PHYSIOLOGY AND PHARMACOLOGY LAB (DSE/PPC)

Hours per week: 3  Credits: 2  Continuous Evaluation:  100 marks

1. Study of route of drug administration in laboratory animals
2. Study of drug action on the eye of the rabbit- Miotics and Mydriatics (software)
3. Study of effect of drugs on intestinal motility using frog’s esophagus model (software)
4. Study of analgesic property of the drug using anlgesiometer (software)
5. Study of anti inflammatory property of the drug using rat paw edema method(software)
6. Study of effect of drugs on locomotor activity using actophotometer and rotorod (software)
SEMESTER- IV

SCY 202: ORGANIC CHEMISTRY III – HETEROCYCLIC CHEMISTRY (CC)

Hours per week: 4  
Credits: 4  
Semester End Examination: 60 Marks  
Continuous Evaluation: 40 marks

UNIT I: Nitrogen Containing Functional Groups
Preparation and important reactions of nitro and compounds, nitriles and isonitriles
Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann’s exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid.
Diazonium Salts: Preparation and their synthetic applications.

UNIT II: Polynuclear Hydrocarbons
Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.

UNIT III: Heterocyclic Compounds
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: Alkaloids
Natural occurrence, General structural features, Isolation. Hoffmann’s exhaustive methylation, Emde’s modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine

UNIT V: Terpenes
Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Neral and α-terpineol.

Reference Books:
- Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
SCY 204: PHYSICAL CHEMISTRY III - PHASE EQUILIBRIA
AND CHEMICAL KINETICS (CC)

Hours per week: 4  Semester End Examination:  60 Marks
Credits: 4  Continuous Evaluation:  40 marks

Unit-I: Phase Equilibria-1
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, with applications.
Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points.

Unit-II: Phase equilibria-2
Three component systems, 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), partial miscibility of liquids, CST, 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.
Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, qualitative treatment of the theory of absolute reaction rates.

Unit-IV: Catalysis:
Definition of catalyst, types of catalysts - Homogeneous and heterogeneous catalysis - acid-base catalysis – prototropic and protolytic mechanism and derivation of rate law, Enzyme catalysis, Michaelis-Menten kinetics.

Unit-V: Surface chemistry:
Physical adsorption, chemisorption, adsorption isotherms – types- Langmuir and Freundlich isotherms
Surface active agents- classification- critical micellar concentration (CMC) - factors affecting the CMC of surfactants- determination of cme. Solubilisation-factors influencing the solubilization. Explanation of cleansing action of detergents.

Reference Books:

SCY 206: PHYSICS III –MECHATRONICS II (GE)

Hours per week: 4  Semester End Examination:  60 Marks
Credits: 4  Continuous Evaluation:  40 marks

UNIT –I: Kinematic analysis of mechanisms
Introduction to mechanisms-Kinematic pairs and chains-velocity analysis-Relative velocity method-Slider crank and four bar mechanism-Instantaneous center method-Arnold Kennedy theorem. Acceleration analysis-procedure to draw acceleration polygon of mechanism-coriolis acceleration and analytical method.
UNIT –II: Synthesis of Mechanisms
Straight line motion-Mechanisms: Exact straight line generating mechanisms-Peaucellier approximate Straight Line Generating Mechanisms-Watt-Grasshopper and Tchebicheff’s. Compliant mechanisms-Flexure based straight line mechanism. Offset slider crank mechanisms-Pantograph.

UNIT –III: Fluid Kinematics
Introduction methods of describing fluid motion-types of fluid flow-rate of flow or discharge-continuity equation and continuity equation in three dimensions-velocity and acceleration-velocity potential functions and stream function and type of motion.

UNIT –IV: Fluid Dynamics
Introduction, equations of motion-Euler’s equation of motion-Bernoulli’s equation from Euler’s equation-Bernoulli’s equation for real fluid-momentum equation-force exerted by flowing fluid on pipe bend-moment of momentum equation Applications of momentum equations-Fluid flow measurements-Introduction venturimeter-orifice plate and pitot tube.

UNIT –V: Hydraulic Pumps
Introduction-pumps-centrifugal pump-effect of vane shape and operating variables performance characteristics of centrifugal pump-Hydraulic turbine-Pelton turbine-performance characteristics of hydraulic turbines-Reciprocating pump-inertia effect on pressure head and effect of friction pressure head

Text Books
3. Fluid Mechanics and Hydraulic Machines S.C Gupta Pearson Education

SCY 242: BASIC CONCEPTS OF MEDICINAL CHEMISTRY (DSE)

Hours per week: 4 Semester End Examination: 60 Marks
Credits: 4 Continuous Evaluation: 40 marks

UNIT-I : Drug structure and biological activity: Pharmaceutically important functional groups-alcohols, carboxylic acid, amines, sulfonamides and carbonyl compounds. Basic reactions for drug molecule synthesis: Aldol, Diels-Alder, Claisen, Grignard, Michael, and Mannich reactions

UNIT-II: Chemistry of drug metabolism- absorption distribution, drug metabolism and excretion site specificity, stability, prolong release, minimum toxicity, patient acceptance.

UNIT-III : Vitamines: Structure, physiological role and uses of Vitamins A, Vitamin D Thiamine (B1) and Pyridoxine (B6).

UNIT-IV :
Chemistry of selected drugs- Synthesis and basic concept of action for the following drugs
(i) Anticancer: 5-Fluorouracil
(ii) Antimalarials: Chloroguanide
(iii) Anti-inflammatory: Diclofenac Sodium
(iv) Sedatives: Phenobarbital
UNIT-V:
Chemistry of selected drugs- Synthesis and basic concept of action for the following drugs
(i) Antiulcers and antacids: Omeprazole
(ii) Antiviral: Acyclovir
(iii) Antihistaminic: Cinnarizine
(iv) Antiasthmatic agents: Salbutamol

Books Recommended

Reference book
1. Essentials of Medicinal Chemistry, Andrejus Korolkovas ,II Ed. ,Wiely India, 2008

SCY 244: FUNDAMENTALS OF INSTRUMENTAL METHODS
OF ANALYSIS (DSE)

Hours per week: 4   Semester End Examination: 60 Marks
Credits: 4     Continuous Evaluation: 40 marks

Unit I: Infrared spectroscopy - Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR).

UV-Visible/ Near IR – emission, absorption, fluorescence and photoacoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments.

Unit II: Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole.


Unit III - Separation techniques

High performance liquid chromatography: Theory and instrumentation: pumps, column, detectors-UV detector, refractive index detector, Fluorescence detector, photo diode array detector, applications.

Gas liquid chromatography: Theory and instrumentation: columns (packed and capillary columns), detector: thermal conductivity detector, flame ionization detector, electron capture detector, nitrogen-phosphorus detector, photo ionization detector, and applications.
Unit IV - Elemental analysis:
Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence:
Excitation and getting sample into gas phase (flames, electrical discharges, plasmas),
Wavelength separation and resolution (dependence on technique), Detection of radiation,
matrix effects, other interferences).

Unit V: Radiochemical Methods: Detection and measurement of radioactivity, introduction
to radioactive tracers. Applications of tracer technique: isotope dilution analysis -
applications, activation analysis - applications, advantages and disadvantages. Radio Carbon
dating technique

X-ray analysis and electron spectroscopy (surface analysis): theory, instrumentation and
applications X-ray electron spectroscopy

Suggested books:
- Willard, Merritt, Dean, Settle, Instrumental Methods of Analysis, 7th ed, IBH Book
  House, New Delhi.
- Kakkar, R. Atomic and Molecular Spectroscopy: Concepts and Applications. Cambridge
  University Press, 2015.

SCY 246: GREEN CHEMISTRY (DSE)

Hours per week: 4  Semester End Examination: 60 Marks
Credits: 4  Continuous Evaluation: 40 marks

UNIT-I: Introduction to Green Chemistry
Green chemistry - Introduction - need for green chemistry - goals of green chemistry -
Anastas' twelve principles of green chemistry - Designing a green synthesis (tools) - choice of
starting materials, solvents, catalysts, reagents, processes with suitable examples.

UNIT -II: Ionic liquids - synthesis, physical properties of ionic liquids - applications in
alkylation, epoxidation, Friedal-Crafts reaction - Diels-Alder reactions – Knoevenegal
condensations and Wittig reactions.
Phase Transfer Catalyst (PTC) - Definition - advantages, types of PTC reactions - synthesis
of PTC, applications of PTC in organic synthesis - Michael reaction - alkylation of aldehydes
and ketones. Wittig, generation of dihalocarbene, elimination reaction

UNIT -III: Supercritical CO₂ - phase diagram - uses in extracting natural products, dry
cleaning, bromination, Kolbe-Schmidt synthesis - Friedel-crafts reaction. Dimethyl carbonate
as a methylating agent in green synthesis

UNIT- IV: Microwave and Ultrasound Assisted Reactions
Microwave activation - advantages of microwave exposure - Microwave assisted reactions,
condensation reactions - oxidation, reduction reactions, multicomponent reactions.
**Sonochemistry** - use of ultrasound in organic synthesis (alternate source of energy) - saponification - substitution, addition, oxidation reactions, reductions.

**UNIT-V: Green Analytical Techniques**
Micelle mediated extraction- Cloud point extraction and adsorptive miceller flocculation methods. Solid Phase Micro Extraction (SPME)

**Text books:**

**SSE 252: CHEMICAL TECHNOLOGY & SOCIETY (SEC)**

| Hours per week: 2 | Credits: 2 | Semester End Examination: 60 Marks | Continuous Evaluation: 40 marks |

**Chemical Technology**
Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology.

**Society**
Exploration of societal and technological issues from a chemical perspective. Chemical and scientific literacy as a means to better understand topics like air and water, energy from natural sources (i.e. solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids.

**Reference Book:**

**SSE 254: INDUSTRIAL SAFETY (SEC)**

| Hours per week: 2 | Credits: 2 | Semester End Examination: 60 Marks | Continuous Evaluation: 40 marks |

Introduction to Industrial Hygiene & Historical views, Definitions and professionals involved in industrial Hygiene work.
Safety and Hygiene aspects related to

i. Transport, handling & storage of inflammable liquids & gases & toxic materials
ii. Process equipment including piping (fire, static electricity, pressure, temperature etc.)
safety aspects at process development & design stage.

Threshold Limit Value (TLV) and Permissible Exposure Limits (PEL) for chemicals,
Industrial toxicology and the basics, Classification of toxic agents.

**SCY 220 ORGANIC CHEMISTRY III LAB (PPC)**

Hours per week: 3  
Credits: 2  
Continuous Evaluation: 100 marks

Detection of extra elements.
1. Functional group test for nitro, amine and amide groups.
2. Qualitative analysis of unknown organic compounds containing simple functional
   groups (alcohols, carboxylic acids, phenols and carbonyl compounds)

**Reference Books**


**SCY 222 PHYSICAL CHEMISTRY III LAB (PPC)**

Hours per week: 3  
Credits: 2  
Continuous Evaluation: 100 marks

I. Determination of critical solution temperature and composition of the phenol-water
   system and to study the effect of impurities on it.

II. Phase equilibria: Construction of the phase diagram using cooling curves or ignition
    tube method:
    a. simple eutectic and
    b. congruently melting systems.

III. Distribution of acetic/ benzoic acid between water and cyclohexane.

IV. Study the equilibrium of at least one of the following reactions by the distribution
    method:

   (i) \( I_2(aq) + I^- \rightarrow I_3^-(aq)^{2+} \)

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

V. Study the kinetics of the following reactions.
   1. Integrated rate method:
      Acid hydrolysis of methyl acetate with hydrochloric acid.
   2. Compare the strengths of HCl and H2SO4 by studying kinetics of hydrolysis of methyl
      acetate.
VI. Adsorption

I. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

Reference Books:

SCY 224: MEDICINAL CHEMISTRY Lab (PPC)

Hours per week: 3    Credits: 2    Continuous Evaluation: 100 marks

(1) Assay of Ibuprofen by alkalimetry.
(2) Assay of Diclofenac by alkalimetry.
(3) Assay of Analgin by iodimetry
(4) Assay of Lidocaine HCl by nonaqueous titrimetry
(5) Assay of Metronidazole by nonaqueous titrimetry
(6) Preparation of Benzimidazole from O-phenyline diamine
(7) Preparation of Benzotriazole from O-phenyline diamine
(8) Preparation of Para amino salicylic acid from p-nitro salicylic acid
(9) Preparation of Chlorbutol
(10) Preparation of Benzil from benzoin
(11) Preparation of Phenytoin from benzyl
(12) Preparation of Benzocaine from p-amino benzoic acid
(13) Preparation of 7-hydroxy, 4-methyl coumarin
(14) Preparation of paracetamol
(15) Preparation of Aspirin
At least 8-10 of the above (Assay:3-4 and Preparations:5-6)

SCY 226: INSTRUMENTAL METHODS OF ANALYSIS Lab (PPC)

Hours per week: 3    Credits: 2    Continuous Evaluation: 100 marks

1. Safety Practices in the Chemistry Laboratory
2. Titration curve of an amino acid.
3. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.)
4. IR Absorption Spectra (Study of Aldehydes and Ketones)
5. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption
6. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)
7. Separation of Carbohydrates by HPLC
8. Potentiometric Titration of a Chloride-Iodide Mixture
9. Laboratory analysis to confirm anthrax or cocaine
10. Detection in the field and confirmation in the laboratory of flammable accelerants or explosives
11. Detection of illegal drugs or steroids in athletes
12. Detection of pollutants or illegal dumping

At least 8-10 experiments to be performed.

Reference Books:

**SCY 228: GREEN CHEMISTRY LAB**

Hours per week: 3   Credits: 2   Continuous Evaluation: 100 marks

1. Safer starting materials
   - Preparation and characterization of nanoparticles of gold using tea leaves.

2. Using renewable resources
   - Preparation of biodiesel from vegetable waste cooking oil.

3. Avoiding waste
   Principle of atom economy.
   - Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.
   - Preparation of propene by two methods can be studied
     (I) Triethylamine ion + OH$^- \rightarrow$ propene + trimethylpropene + water
     $$H_2SO_4/\Delta$$
     (II) 1-propanol $\rightarrow$ propene + water
   - Other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

4. Use of enzymes as catalysts
   - Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.

5. Alternative Green solvents
   Extraction of D-limonene from orange peel using liquid CO2 prepared form dry ice.
   Mechanochemical solvent free synthesis of azomethines

6. Alternative sources of energy
   - Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).
   - Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Reference Books:
SCY 230: PHYSICS II- MECHATRONICS-2 LAB

Hours per week: 3    Credits: 2    Continuous Evaluation: 100 marks

List of Experiments:
1. Calibration of small orifice
2. Calibration mouthpiece by constant head method and falling head method.
3. Calibration of orifice meter and nozzle meter,
4. Verification of Bernoulli’s equation
5. Calibration of Venturimeter
6. Performance characteristics of centrifugal pump
7. Performance characteristics of reciprocating pump
8. Performance characteristics of Pelton wheel turbine
9. Pitot tube
SEMESTER V

SCY 301: INORGANIC CHEMISTRY III - COORDINATION CHEMISTRY (CC)

Hours per week: 4                Semester End Examination:  60 Marks
Credits: 4                         Continuous Evaluation:      40 marks

Unit-I: Transition Elements:
General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes.
Chemistry of Ti, V, Cr, Mn, Fe and Co in various oxidation states (excluding their metallurgy)

Unit-II: Lanthanoids and Actinoids:
Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

Unit-III: 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-IV: Coordination Chemistry-II
Werner’s theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of 10 Dq (o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (o, t). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem.

Unit-V: Bioinorganic Chemistry
Metal ions present in biological systems, Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. 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. Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

Reference Books:

SCY 303: ORGANIC CHEMISTRY IV- BIOMOLECULES (CC)

Hours per week: 4                Semester End Examination:  60 Marks
Credits: 4                         Continuous Evaluation:      40 marks

UNIT - I: Nucleic Acids
Components of nucleic acids, Nucleosides and nucleotides;
Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine;

Amino Acids, Peptides and Proteins
Amino acids, Peptides and their classification.
α-Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pKα values, isoelectric point and electrophoresis;
UNIT II: Enzymes
Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.
Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity).

UNIT III: Lipids
Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity.

UNIT IV: Concept of Energy in Biosystems
Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism).
ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD+, FAD.
Conversion of food to energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle.

UNIT V: Pharmaceutical Compounds: Structure and Importance
Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol

Reference Books:

SCY 305: PHYSICAL CHEMISTRY IV - ELECTROCHEMISTRY (CC)

Hours per week: 4 Semester End Examination: 60 Marks
Credits: 4 Continuous Evaluation: 40 marks

Conductance
Unit –I:
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.

Unit –II:
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.

Electrochemistry
Unit –III:
Quantitative aspects of Faraday’s laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials. Chemical cells, reversible and irreversible cells with examples.
Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. 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.

**Unit -IV**
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 –V: Electrical & Magnetic Properties of Atoms and Molecules**
Basic ideas of electrostatics, Electrostatics of dielectric media, Dipole moment and molecular polarizabilities and their measurements. Diamagnetism, paramagnetism, magnetic susceptibility and its measurement.

**Reference Books:**

**SCY 341: PHARMACEUTICS – 1 (DSE)**

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<th>Hours per week: 4</th>
<th>Semester End Examination: 60 Marks</th>
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<td>Credits: 4</td>
<td>Continuous Evaluation: 40 marks</td>
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**UNIT –I:**
Study of the following dosage forms including the definition, types, formulation design, development, scale up and testing of Monophasic liquid dosage forms: Mouth Washes, Ear Drops, Nasal Drops, Lotions. Only Definition of Gargles, Throat Paints, Liniments, Enemas and Colloids Biphasic Liquid dosage forms - Suspensions and Emulsions

**UNIT –II:**
Tablets: definition, types, formulation design and development with details functions excipients, manufacturing process and scale up of unit operations, problems in manufacturing, quality control testing and machinery involved in preparation of tablets Tablet coating: introduction, reasons for coating tablets, types of tablet coating, sugar, film ideal characteristics, formulation design and development with details functions of coating component, process details & equipments used in film coating and scale up of unit operations, defects in coating.

**UNIT – III:**

**UNIT –IV:**
Semi solid preparations: Classification - topical formulations and their application, ointment bases and their application. Unit operations involved in the manufacturing of ointment, cream, paste, lotion and gel formulations, CQA for ointment, cream, paste and gel formulations, CPP and CMA for ointment, cream, paste and gel manufacturing process.
UNIT – V:
Sustained and Controlled Release Dosage Forms: Definition, types, formulation design of matrix dosage form and pellets and evaluation.
Introduction to labelling & Packaging, types of packaging materials, factors effecting selection of containers, materials used for containers & closures, drug-container considerations, quality control tests for packaging materials.

Recommended Books:
5. Indian Pharmacopoeial Government of India, Ministry of Health & Family Welfare, the Indian Pharmacopoeial Commission, Ghaziabad, 2007

SCY 343: UNIT OPERATIONS IN CHEMICAL ENGINEERING (DSE)

Hours per week: 4 Semester End Examination: 60 Marks
Credits: 4 Continuous Evaluation: 40 marks

UNIT –I:
Filtration: Types of filters batch, continuous filtration, Centrifugation-batch, continuous and basket, inverting bag, bottom discharge, micron, and cartridge filters, Factors affecting filtration and selection of filtration equipment. Microfiltration
Extraction and Leaching: Introduction-extract, raffinate, choice of solvent for extraction, single stage, multistage extraction, Equipment for extraction operation: lipid liquid extractor, factors affecting extraction and leaching, leaching and its applications.

UNIT –II:
Distillation: Binary systems relative volatility, Ideal solutions, Steam distillation, continuous distillation, azeotropic distillation, extractive distillation, batch distillation, flash distillation, distillation under reduced pressure – FEE, ATFE t.
Crystallization: principles, super saturation cooling crystallization, reactive crystallization, seeding, formation of polymorph, type of agitators, factors affecting crystallization classification of crystallizers, equipment – crystallization in batch reactors.

UNIT –III:
Drying: Definition, Applications, purpose of drying, classification of dryers, drying equipment-Tray dryer, rotary dryers, pneumatic dryer, spray dryer, drum dryer, VTD, FBD, RCVD, RCVD, ATFD, ANFD, Spherical dryer. (Basic theoretical concepts with more practical applications)
UNIT –IV:
Size separation/reduction: Grinders –types-circuit, screening-industrial screens, gyratory and vibratory screens-air jet mail, multi mail, Co mail, bantam mill, hammer mill, sifter Mixing-
Homogenous, Heterogeneous.
Blending – types of blender octagonal, hexagonal, double cone type.

UNIT –V:
Reactor studies : Basic functions of a reactor, autoclave types –batch, CSTR, semi batch, body construction, types of agitators- Spargers, gas induction turbine, anchor, PBT, propeller Unit processes and operations: Oxidation, reduction, dehydration, condensation, Hydrolysis hydrogenation, neutralization, fridel – craft reaction, basis of pH, evaporation, column chromatography, membrane separation, bromination, chlorination humidification, basics of organic chemistry, absorption, adsorption.

Recommended books:
1. Author: Julian C. Smith , Warren L. McCabe , Peter Harriott
   Unit Operations of Chemical Engineering (English), 7th Edition, Mcgraw Hil Education
2. Author: Shyamal K Sanyal , Salil K Ghosal , Siddhartha
   Introduction to Chemical Engineering (English), 1st Edition, Mcgraw Hill Education

SCY 321: INORGANIC CHEMISTRY - III LAB (CC/PPC)

Gravimetric Analysis:
  i. Estimation of nickel (II) using Dimethylglyoxime (DMG).
  ii. Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)$_3$
      (aluminium oxinate).

Inorganic Preparations:
  i. Tetraamminecopper (II) sulphate, [Cu(NH$_3$)$_4$]SO$_4$.H$_2$O
  ii. Cis and trans K[Cr(C$_2$O$_4$)$_2$. (H$_2$O)$_2$] Potassium dioxalatodiaquachromate (III)
  iii. Tetraamminecarbonatocobalt (III) ion
  iv. Potassium tris(oxalate)ferrate(III)

Infrared spectroscopy
Characterization of few inorganic complexes using FT-IR spectrophotometer

Reference Book:

SCY 323: ORGANIC CHEMISTRY –IV LAB (CC/PPC)

1. Estimation of glycine by Sorenson’s formalin method.
2. Study of the titration curve of glycine.
4. Study of the action of salivary amylase on starch at optimum conditions.
5. Effect of temperature on the action of salivary amylase.
6. Saponification value of an oil or a fat.
7. Determination of Iodine number of an oil/fat.
8. Isolation and characterization of DNA from onion/cauliflower/peas.

Reference Books:

**SCY 325: PHYSICAL CHEMISTRY-IV LAB**

Hours per week: 3  
Credits: 2  
Continuous Evaluation: 100 marks

**Conductometry**

I. Determination of cell constant
II. Determination of equivalent conductance, 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

**Potentiometry**

I. Perform the following potentiometric titrations:
   i. Strong acid vs. strong base
   ii. Weak acid vs. strong base
   iii. Potassium dichromate vs. Mohr's salt

Reference Books:

**SCY 327: PHARMACEUTICS – 1 Lab**

Hours per week: 3  
Credits: 2  
Continuous Evaluation: 100 marks

1. Preparation & Evaluation of granules loaded with Active Pharmaceutical Ingredients
2. Preparation & Evaluation of Tablets
3. Preparation & Evaluation of Film Coated Tablets
4. Preparation & Evaluation of Capsules
5. Preparation and evaluation of semi solid dosage forms.
SCY 329: UNIT OPERATIONS IN CHEMICAL ENGINEERING Lab

Hours per week: 3   Credits: 2   Continuous Evaluation: 100 marks

1. Bioreactor components & its operation
2. Mixing time in a bioreactor

3. Simple distillation technique
4. Steam distillation technique
5. Filtration techniques
6. Evaporation techniques
7. Centrifugation techniques
8. Product purification techniques
9. Chromatographic techniques
10. Product extraction techniques
11. Size reduction techniques
12. Heat exchangers
13. Sterilization techniques
SEMESTER VI

SCY 302: INORGANIC CHEMISTRY IV - ORGANOMETALLIC CHEMISTRY (CC)

Hours per week: 4   Semester End Examination: 60 Marks
Credits: 4           Continuous Evaluation: 40 marks

Unit-I: Theoretical Principles in Qualitative Analysis (H2S Scheme)
Basic principles involved in analysis of cations and anions and solubility products, common ion effect. Principles 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-1
Definition and classification of organometallic compounds on the basis of bond type. Zeise’s salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbynols.
Metal carbynols: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbynols of 3d series. General methods of preparation (direct combination, reductive carbynolation, thermal and photochemical decomposition) of mono and binuclear carbynols of 3d series. Structures of mononuclear and binuclear carbynols of Cr, Mn, Fe, Co and Ni of using VBT. π-acceptor behaviour of CO (MO diagram of CO to be discussed).

Unit-III: Organometallic Compounds-2
Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds. Role of triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium.
Ferrocene: Preparation and structures of ferrocene. Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene.

Unit-IV: Catalysis by Organometallic Compounds
Study of the following industrial processes and their mechanism:
1. Alkene hydrogenation (Wilkinson’s Catalyst)
2. Hydroformylation (Co salts)
3. Wacker Process
4. Synthetic gasoline (Fischer Tropsch reaction)
5. Synthesis gas by metal carbonyl complexes

Unit-V: Reaction Kinetics and Mechanism
Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates.

Reference Books:
SCY 304: ORGANIC CHEMISTRY IV - SPECTROSCOPY (CC)

Hours per week: 4  Semester End Examination: 60 Marks
Credits: 4  Continuous Evaluation: 40 marks

UNIT - I: Organic Spectroscopy
General principles Introduction to absorption and emission spectroscopy.
UV Spectroscopy: Types of electronic transitions, \( \lambda \) max, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of \( \lambda \)max for the following systems: \( \alpha,\beta \) unsaturated aldehydes, ketones, Conjugated dienes: alicyclic, homoannular and heteroannular.

UNIT- II:
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 III:
NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds. Applications of IR, UV and NMR for identification of ethyl alcohol, cinnamic acid, acetonilide, benzaldehyde

UNIT - IV: Carbohydrates
Occurrence and classification.
Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis.
Disaccharides – Structure elucidation of maltose, lactose and sucrose.

UNIT- V: Dyes and polymers
Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing; Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling).

Polymers
Introduction and classification including; Number average molecular weight, Weight average molecular weight, Degree of polymerization.
Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene);

Reference Books:
- Billmeyer, F. W. Textbook of Polymer Science, John Wiley & Sons, Inc.
- Kemp, W. Organic Spectroscopy, Palgrave.
SCY 306: PHYSICAL CHEMISTRY V - QUANTUM CHEMISTRY & SPECTROSCOPY (CC)

Hours per week: 4  
Semester End Examination: 60 Marks  
Credits: 4  
Continuous Evaluation: 40 marks

**Unit –I: Quantum Chemistry-1**
Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and “particle-in-a-box” (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation. Vibrational energy of diatomic molecules, rigid rotator model of rotation of diatomic molecule and zero-point energy.

**Unit –II: Quantum Chemistry-2**
Qualitative treatment of hydrogen atom; setting up of Schrödinger equation in spherical polar coordinates.
Setting up of Schrödinger equation for many-electron atoms (He). Need for approximation methods. Statement of variation theorem and application to simple systems (harmonic oscillator).

**Unit-III: Molecular Spectroscopy-1**
Interaction of electromagnetic radiation with molecules and various types of spectra.
Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.
Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, fundamental frequencies, overtones, hot bands.
Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

**Unit-IV: Molecular Spectroscopy-2**
Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, chemical shift, different scales, spin-spin coupling and interpretation of PMR spectra of organic molecules.
Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

**Unit-V: Photochemistry**

**Reference Books:**
SCY 342: PHARMACEUTICS -II (DSE)

Hours per week: 4
Credits: 4
Semester End Examination: 60 Marks
Continuous Evaluation: 40 Marks

UNIT –I:
Parenterals: Definition, types, vehicles, used and quality control tests for parenterals.
Formulation design, development and scale up of SVP and LVP

UNIT –II:
Sterilization and Depyrogenation:
Unit operations in Aseptic manufacturing, Moist heat sterilization and autoclaving cycle,
Importance of F and Z value, Sterility Assurance Level (Overkill approach) and D value,
Loading pattern and biological indicators, Mechanism of sterilization using Dry Heat and F_H
Value, bacterial endotoxin,
D pyrogenation, sterile filtration and filter media, Filter integrity testing and bubble point

UNIT-III:
Aseptic Processing & Interventions: compounding for sterile filtration, aseptic processing
and aseptic interventions, aseptic process simulation and regulatory expectation, lyophilisation
and freeze drying, fibre and explain impact of extraneous matter in the final product, Visual
inspection and factors

UNIT-IV:
Cleaning and Sanitization: Define and classify microorganism, impact of microbial
contamination on sterile product, various sources of microbial contamination, clean room
behaviour and aseptic gowning, cleaning in aseptic area, decontamination of isolators using
VHP, Physical and Chemical means of Disinfection, Environment Monitoring.

UNIT-V:
Visual Inspection: Personal Qualification as per SOP OPR 012
Environment Monitoring: Personal Qualification as per SOP FT7QC084

Recommended books:
1. Leon Lachman, H. A. Lieberman & J. L. Kanig: —The Theory and Practice of Industrial
4. Indian Pharmacopoeial Government of India, Ministry of Health & Family Welfare, the
Indian Pharmacopoeial Commission, Ghaziabad, 2007
8. S.J. Cartar Ed.: —Cooper & Gunn’s Dispensing for Pharmaceutical Students,12th edition,
CBS Publisher, New Delhi, 1987.
UNIT –I: Industrial Gases and Inorganic Chemicals

**Industrial Gases:** Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

**Inorganic Chemicals:** Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

UNIT –II: Environment and its segments


UNIT –III:

Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

**Water Pollution** : Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

UNIT –IV:

Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: textile, tannery, dairy, petroleum and petrochemicals.

Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

UNIT –V: Energy & Environment

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Reference Books:
Qualitative semimicro 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:

- $\text{CO}_3^{2-}$, $\text{NO}_2^{-}$, $\text{S}_2^{2-}$, $\text{SO}_3^{2-}$, $\text{CH}_3 \text{COO}^-$, $\text{F}^-$, $\text{Cl}^-$, $\text{Br}^-$, $\text{I}^-$, $\text{NO}_3^-$, $\text{BO}_3^{3-}$, $\text{C}_2\text{O}_4^{2-}$, $\text{PO}_4^{3-}$, $\text{NH}_4^+$, $\text{K}^+$, $\text{Pb}^{2+}$, $\text{Cu}^{2+}$, $\text{Cd}^{2+}$, $\text{Bi}^{3+}$, $\text{Sn}^{4+}$, $\text{Sb}^{5+}$, $\text{Fe}^{3+}$, $\text{Al}^{3+}$, $\text{Cr}^{3+}$, $\text{Zn}^{2+}$, $\text{Mn}^{2+}$, $\text{Co}^{2+}$, $\text{Ni}^{2+}$, $\text{Ba}^{2+}$, $\text{Sr}^{2+}$, $\text{Ca}^{2+}$, $\text{Mg}^{2+}$

Mixtures should preferably contain one interfering anion, or insoluble component ($\text{BaSO}_4$, $\text{SrSO}_4$, $\text{PbSO}_4$, $\text{CaF}_2$ or $\text{Al}_2\text{O}_3$) or combination of anions e.g. $\text{CO}_3^{2-}$ and $\text{SO}_3^{2-}$, $\text{NO}_2^-$ and $\text{NO}_3^-$, $\text{Cl}^-$ and $\text{Br}^-$, $\text{Cl}^-$ and $\text{I}^-$, $\text{Br}^-$ and $\text{I}^-$, $\text{NO}_3^-$ and $\text{Br}^-$, $\text{NO}_3^-$ and $\text{I}^-$.

Spot tests should be done whenever possible.

1. Measurement of 10 Dq by spectrophotometric method
2. Preparation of acetylacetanato complexes of Cu$^{2+}$/Fe$^{3+}$. Find the $\lambda_{\text{max}}$ of the complex.
3. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetone, DMG, glycine) by substitution method.

**SCY 322: ORGANIC CHEMISTRY LAB (CC/PPC)**

1. Extraction of caffeine from tea leaves.
2. Preparation of urea formaldehyde.
4. Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, for e.g. salicylic acid, cinnamic acid, nitrophenols, etc.
5. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).
6. Preparation of methyl orange.

**Reference Books:**

SCY 324: PHYSICAL CHEMISTRY LAB (CC/PPC)

Hours per week: 3  Credits: 2  Continuous Evaluation: 100 marks

UV/Visible spectroscopy

I. Study the 200-500 nm absorbance spectra of KMnO4 and K2Cr2O7 (in 0.1 M H2SO4) and determine the λmax values. Calculate the energies of the two transitions in different units (J molecule⁻¹, kJ mol⁻¹, cm⁻¹, eV).
II. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of K2Cr2O7.

Colourimetry

I. Verify Lambert-Beer’s law and determine the concentration of CuSO4/KMnO4/K2Cr2O7 in a solution of unknown concentration
II. Determine the concentrations of KMnO4 and K2Cr2O7 in a mixture.
IV. Determine the amount of iron present in a sample using 1,10-phenathroline.
V. Determine the dissociation constant of an indicator (phenolphthalein).
VI. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.
VII. Analysis of the given vibration-rotation spectrum of HCl(g)

Reference Books


SCY 326: PHARMACEUTICS -II LAB (DSE/PPC)

Hours per week: 3  Credits: 2  Continuous Evaluation: 100 marks

1. Sterilization using Autoclave
2. Sterilization using Dry Heat Sterilizer
3. Preparation and evaluation of isotonic solution
4. Filling and crimping of vials
5. Filling and sealing of ampoules
6. Sterile filtration of isotonic solution
7. Collection of Air Sample using Agar Plate
8. Performance of test for sterility of marketed parenteral preparations
9. Aseptic gowning
10. Preparation & Evaluation of Ascorbic acid injection I.P.
11. Preparation of Sodium chloride infusion
SCY 328: INDUSTRIAL CHEMICALS & ENVIRONMENT LAB (DSE/PPC)

Hours per week: 3   Credits: 2   Continuous Evaluation: 100 marks

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO3 and potassium chromate).
6. Estimation of total alkalinity of water samples (CO3²⁻, HCO3⁻) using double titration method.
8. Study of some of the common bio-indicators of pollution.
10. Preparation of borax/boric acid.