HSNC UNIVERSITY, MUMBAI

Board of Studies in Faculties of Science & Technology

Board of Studies in the subject of Chemistry

1) Name of Chairperson/Co-Chairperson/Coordinator:-
    a. **Prof Vijay Dabholkar –P**rofessor, Department of Chemistry, vijay.dabholkar@kccollege.edu.in, 9930658855
    b. **Dr Sheela Valecha-** Associate Professor, Department of Chemistry, **sheela.**valecha@kccollege.edu.in**,** 9820629865

2) Two to five teachers each having minimum five years teaching experience amongst the full-time teachers of the Departments, in the relevant subject.
    a. **Dr. Sunetra Chaudhari,** Associate Professor, Department of Chemistry, K. C. College, sunetra.chaudhari@kccollege.edu.in, 987662407
    b. **Mr. Karun Sodah,** Assistant Professor, Department of Chemistry, K. C. College, karun.sodah@kccollege.edu.in, 7302432297
    c. **Dr. Satish Kolte,** Associate Professor, Department of Chemistry, K. C. College, satish.kolte@kccollege.edu.in, 9821086024
    d. **Dr. Rajesh Samant,** Associate Professor, Department of Chemistry, K. C. College, rajesh.samant@kccollege.edu.in, 9869484326
    e. **Dr. Yogita Shinde,** Assistant Professor, Department of Chemistry, K. C. College, yogita.shinde@kccollege.edu.in, 8828164779
    f. **Dr. Charulata Chaturvedi,** Assistant Professor, Department of Chemistry, K. C. College, charuchatskc@gmail.com, 7738001960
    g. **Mrs. Mridula Gupta,** Assistant Professor, Department of Chemistry, K. C. College, mridula.gupta@kccollege.edu.in, 9930002117

3) One Professor / Associate Professor from other Universities or professor / Associate Professor from colleges managed by Parent Body; nominated by Parent Body;-
    Dr Brijesh Singh, Associate Prof, Vice Principal Head, Department of Chemistry
    Jai hind College, brijesh.singh@jaihindcollege.edu.in, 9820551819

4) Four external experts from Industry / Research / eminent scholar in the field relevant to the subject nominated by the Parent Body.
    a. **Dr Gulzar Waghoo, General Manager-**Technical Nerolac Kansai Paints Ltd Kopar khairne, Navi Mumbai**,** 9819295421

b. **Dr Kiran Mangaonkar, Principal** Guru Nanak Khalsa College, Matunga Mumbai, kiran.mangaonkar@gnkhalsa.edu.in , 9833835824
c. **Dr B. M. Bhanage ,Professor,** Dept of Chemistry ICT Matunga Mumbai, bm.**bhanage**@**ictmumbai**.edu.in, ,9323994018
d. **Dr Shyamlava Mazumdar, Associate Prof** , TIFR Mumbai, shyamal@tifr.res.in, 9869143256

5) Top rankers of the Final Year Graduate and Final Year Post Graduate examination of previous year of the concerned subject as invitee members for discussions on framing or revision of syllabus of that subject or group of subjects for one year.
a. **Dr. Mustaqeem Mohammed, Alumnus,** Assistant Professor, Royal College, Bhayander, mustaqeem19@gmail.com ,9892875479
b. **Dr Jaydeep Gadgil, Alumnus,** Senior Scientist, CiplaLtd, Mumbai, jaydeep.gadgil18@gmail.com, 9773410018
c. **Dr Dilip Tripathi, Alumnus,** Senior Manager, R and D , Jhonson and Jhonson, Mumbai, dtripathi@its.jnj.com, 9920271810.
d. Ms Rashida Mun, Alumnus, Senior Perfumer at Eaglewings Enterprises, LLP, Mumbai, rashida124@hotmail.com, 9619789879

Part – I

R. **** : **The Definitions of The Key Terms Used In The Choice Based Credit System And Grading System Introduced From The Academic Year 2020-2021 Are As Under:**

Outline of Choice Based Credit System as outlined by University Grants Commission:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally, a course which can be chosen from a pool of courses, and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - 2.1 **Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.
     The University/Institute may also offer discipline related Elective courses of **interdisciplinary** nature (to be offered by main discipline/subject of study).
   - 2.2 **Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.
   - 2.3 **Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE)
   Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Choice Base Credit System (CBCS)

CBCS allows students to choose inter-disciplinary, intra-disciplinary courses, skill-oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students.

Honours Program

To enhance employability and entrepreneurship abilities among the learners, through aligning Inter Disciplinary / Intra Disciplinary courses with Degree Program. Honours Program will have 40 additional credits to be undertaken by the learner across three years essentially in Inter / Intra Disciplinary course.

A learner who joins Regular Undergraduate Program will have to opt for Honours Program in the first year of the Program. However, the credits for Honours, though divided across three years can be completed within three years to become eligible for award of Honours Degree.

Program:

A Program is a set of course that are linked together in an academically meaningful way and generally ends with the award of a Degree Certificate depending on the level of knowledge attained and the total duration of study, BSc Programs.

Course:
A 'course' is essentially a constituent of a 'program' and may be conceived of as a composite of several learning topics taken from a certain knowledge domain, at a certain level. All the learning topics included in a course must necessarily have academic coherence, i.e. there must be a common thread linking the various components of a course. A number of linked courses considered together are in practice, a 'program'.

Bridge Course:
Bridge course is visualized as Pre semester preparation by the learner before commencement of regular lectures. For each semester the topics, whose knowledge is considered as essential for effective and seamless learning of topics of the Semester, will be specified. The Bridge Course can be conducted in online mode. The Online content can be created for the Bridge Course Topics.

Module and Unit:
A course which is generally an independent entity having its own separate identity, is also often referred to as a 'Module' in today's parlance, especially when we refer to a 'modular curricular structure'. A module may be studied in conjunction with other learning modules or studied independently. A topic within a course is treated as a Unit. Each course should have exactly 5 Units.

Self-Learning:
20% of the topics will be marked for Self-Learning. Topics for Self-Learning are to be learned independently by the student, in a time-bound manner, using online and offline resources including online lectures, videos, library, discussion forums, field work, internships etc.

Evaluative sessions (physical/online), equivalent to the credit allocation of the Self Learning topics, shall be conducted, preferably, every week for each course. Learners are to be evaluated real time during evaluative sessions. The purpose of evaluative sessions is to assess the level of the students' learning achieved in the topics earmarked for Self-Learning.

The teacher's role in these evaluative sessions will be that of a Moderator and Mentor, who will guide and navigate the discussions in the sessions, and offer concluding remarks, with proper reasoning on the aspects which may have been missed by the students, in the course of the Self-Learning process.

The modes to evaluate self-learning can be a combination of the various methods such as written reports, handouts with gaps and MCQs, objective tests, case studies and Peer learning. Groups can be formed to present self-learning topics to peer groups, followed by Question-and-Answer sessions and open discussion. The marking scheme for Self-Learning will be defined under Examination and Teaching.

The topics stipulated for self-learning can be increased or reduced as per the recommendations of the Board of Studies and Academic Council from time to time. All decisions regarding evaluation need to be taken and communicated to the stakeholders preferably before the commencement of a semester. Some exceptions may be made in exigencies, like the current situation arising from the lockdown, but such ad hoc decisions are to be kept to the minimum possible.

Credit Point:
Credit Point refers to the 'Workload' of a learner and is an index of the number of learning hours deemed for a certain segment of learning. These learning hours may include a variety of learning activities like reading, reflecting, discussing, attending lectures / counseling sessions, watching especially prepared videos, writing assignments, preparing for examinations, etc. Credits assigned for a single course always pay attention to how many hours it would take for a learner to complete a single course successfully. A single course should have, by and large a course may be assigned anywhere between 2 to 8 credit points wherein 1 credit is construed as corresponding to approximately 30 to 40 learning hours.

Credit Completion and Credit Accumulation:
Credit completion or Credit acquisition shall be considered to take place after the learner has successfully cleared all the evaluation criteria with respect to a single course. Thus, a learner who successfully completes a 4 CP (Credit Point) course may be considered to have collected or acquired 4 credits. learner level of performance above the minimum prescribed level (viz. grades / marks obtained) has no bearing on the number of credits collected or acquired. A learner keeps on adding more and more credits as he completes successfully more and more courses. Thus, the learner 'accumulates' course wise credits.

Credit Bank:
A Credit Bank in simple terms refers to stored and dynamically updated information regarding the number of Credits obtained by any given learner along with details regarding the course/s for which Credit has been given, the course-level, nature, etc. In addition, all the information regarding the number of Credits transferred to different programs or credit exemptions given may also be stored with the individual's history.

Credit Transfer:
(Performance transfer) When a learner successfully completes a program, he/she is allowed to transfer his/her past performance to another academic program having some common courses and Performance transfer is said to have taken place.

Course Exemption:
Occasionally, when two academic programs offered by a single university or by more than one university, may have some common or equivalent course-content, the learner who has already completed one of these academic programs is allowed to skip these 'equivalent' courses while registering for the new program. The Learner is 'exempted' from 'relearning' the common or equivalent content area and from re-appearing for the concerned examinations. It is thus taken for granted that the learner has already collected in the past the credits corresponding to the exempted courses.

Note: The Ordinances and Regulations given below are applicable to Program of BSC under faculty of science, unless and otherwise specified.

O***
Minimum duration of the BSC programme will be of 3 years in the Semester pattern i.e. from Sem. I to Sem. VI.

The degree will be awarded to a learner who successfully completes 144 credits of the programme in period of 3 to 6 years from the year of enrollment to semester VI.

If a learner does not earn 120 credits in 12 semesters from the year of enrolment to semester I, he/she may at his/her option transfer his/her performance in the existing/new program after establishing equivalence between old and new syllabus. Such a performance transfer will be decided by the Board of Studies / Ad-hoc Board / Ad hoc Committee of the concerned subject. The admission to the program will be governed by the existing rules.

O*** The fees for transfer of credits or performance will be based on number of credits that a learner has to complete for award of the degree.**

R **** Credits earned at one institution for one or more courses under a given program will be accepted under another program either by the same institution or another institution either through Direct Performance Transfer or Course exemption.

R** The Scheme of Teaching and Examination**:
The Scheme of Teaching and Examination shall be divided into THREE components, SELF LEARNING, Internal assessment and External assessment (semester end examination) for each course of the program.

1) **SELF LEARNING** Assessment. Some methodology has been described in Definition of Self Learning. However Subject Teacher is authorized to devise newer methods of evaluation, which must essentially be documented and circulated through mail or written circular to the learners at least 7 days prior to its implementation. 10% of the marks shall be allocated for Self-Learning assessment.

2) **Internal Assessment** includes Assignments, Seminars, Core Practical, Practical, Commutative Test, Practical Record, Unit Tests etc. Subject Teacher is authorized to devise newer methods of evaluation, which must essentially be documented and circulated through mail or written circular to the learners at least 7 days prior to its implementation. For each course, there is a passing minimum for internal Assessment as 30% (12 out of 30 marks).

3) **Semester End Examination** 60% (24 out of 60 marks) overall 40% (40 out of 100 marks).

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3) Semester End Examination 60% (24 out of 60 marks) overall 40% (40 out of 100 marks).

Modality of Assessment

(A) Theory Examination Pattern:

Evaluation Scheme (60:40):

a) Semester End Theory Assessment - 60 Marks

i. **Duration** - These examinations shall be of 2 1/2 Hours duration.

ii. **Theory question paper pattern** :-

1. There shall be four questions. On each unit there will be one question with 15 Marks each & fourth one will be based on all the three units with 15 Marks.
2. All questions shall be compulsory with internal choice within the questions. Question 1 (Unit-I),Question 2 (Unit-II) & Question 3 (Unit-III) & Question 4 (combined units) will be of 60 Marks with internal options.
3. Questions I, II and III may be sub divided into sub questions of short or long questions of 5 marks each. Please note that the allocation of marks depends on the weightage of the topic.
4. Question IV will be objective questions.
5. The theory paper will be based on 75% option in the respective questions.

b) Internal - 40 Marks

- 20 Marks Test
- 15 Marks Projects/Presentations (On Current topics/Syllabus)
- 5 Marks Overall Conduct and Active Participation

R.**** Passing Standard and Performance Grading:**

PASSING STANDARD:

The learners to pass a course shall have to obtain a minimum of 40% marks in aggregate for each course where the course consists of Internal Assessment & Semester End Examination. The learners shall obtain minimum of 40% marks in both the internal Assesment(i e. 16 out of 40) and semester end examination (i.e. 24 out of 60) as individual passing to get minimum E grade in each project, wherever applicable, to pass a particular semester. A learner will be said to have passed the course if the learner passes the Internal Assessment & Semester End Examination together.

PERFROMANCE GRADING:

The Performance Grading of the learners shall be on the TEN-point ranking system as under:

Grade	Marks Grade	Points
O+	90 & above	10
O	80 to 89.99	9
A+	70 to 79.99	8
A	65 to 69.99	7
B+	60 to 64.99	6
B	55 to 59.99	5
C	50 to 54.99	4
D	45 to 49.99	3
E	40 to 44.99	2
F	(Fail) 39.99 & below	1

The performance grading shall be based on the aggregate performance of Internal Assessment and Semester End Examination.

R. ** Carry Forwards of Marks: In Case of A Learner Who Fails In The Internal Assessment And /Or Semester End Assessment In One Or More Subjects:**

1) A learner who PASSES in the Internal Examination but FAILS in the Semester End Examination of the course shall re-appear for the Semester End Examination of that course. However, his/her marks of the Internal Examinations shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

2) A learner who PASSES in the Semester End Examination but FAILS in the Internal Assessment of the course shall re-appear for the Internal Examination of that course. However, his/her marks of the Semester End Examination shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

R.** ALLOWED TO KEEP TERMS (ATKT):**

a. A learner shall be allowed to keep term for Semester II irrespective of number of heads of failure in the Semester I.
b. A learner shall be allowed to keep term for Semester III if he/she passes each of Semester I and Semester II
   OR
c. learner who fails in not more than two courses of Semester I and Semester II taken together.
d. A learner shall be allowed to keep term for Semester IV irrespective of number of heads of failure in Semester III. However, the learner shall pass each course of Semester I and Semester II in order to appear for Semester IV.
e. A learner shall be allowed to keep term for Semester V if he/she passes Semester I, Semester II, Semester III and Semester IV
   OR
f. learner shall pass Semester I and Semester II and fails in not more than two courses of Semester III and Semester IV taken together.
g. A learner shall be allowed to keep term for Semester VI irrespective of number of heads of failure in the Semester V. However, the learner shall pass each course of Semester III and Semester IV in order to appear for Semester VI.
h. The result of Semester VI of a learner, in regular program, shall be kept in abeyance until the learner passes each of Semester I, Semester II, Semester III, Semester IV and Semester V.
i. The result of Semester VI of a learner, in Honours program, shall be kept in abeyance until the learner passes each of Semester I, Semester II, Semester III, Semester IV and Semester V and additional

R. ** ADDITIONAL EXAMINATION:**

INTERNAL ASSESSMENT:

Eligibility norms to appear for the additional class test or assignment or project for learners who remained absent:

a. The learner must apply to the Head of the Institution / School / Department giving the reason(s) for absence within 8 days of the conduct of the examination along with the necessary documents and testimonials.
b. If the learner is absent, on sanctioned lave from head of Institution / School / Department, for participation in Inter Collegiate events, State or National or International level events, Training camp or coaching camp organized by authorized university or state or national or international bodies, NSS / NCC Events / Camps / cultural activities / sports activities / research festival or any

other activities authenticated by the head of the institution, the head of the Institution shall generally grant permission to the learner to appear for the additional class test or assignment.

c. The Head of the Institution, on scrutiny of the documents and testimonials, may grant the permission to the learner to appear for the additional examination.

Class test or assignment for Internal Assessment:

a. A learner who is absent for the class test and for all the assignment/s will be declared fail in the Internal Assessment Scheme.
b. A learner who is absent for the class test and has appeared for all the assignment/s will be allowed to appear for the additional class test.
c. A learner who has appeared for the class test but remains absent for all the assignment/s will be allowed to appear for only one additional assignment.
d. A learner who is absent for the class test or one assignment as the case may be the learner will be allowed to appear for the additional class test/assignment.

The Additional Class Test (or viva examination) or Assignment must be conducted 15 days prior to the commencement of the Semester End Examination after following the necessary procedure and completing the formalities.

SEMESTER END EXAMINATIONS

Eligibility to Appear for Additional Semester End Examination:

a. A learner who does not appear i.e. remains absent in some or all the courses on medical grounds or for representing the college / university in sports, cultural activities, activities of NSS, NCC or sports training camps conducted by recognized bodies / competent authorities or for any other reason which is considered valid under exceptional circumstances and to the satisfaction of the
b. Principal or the Head of the Institute OR fails in some or all the subjects is eligible to appear for the additional examination.
c. A learner who does not appear for both the Internal Assessment and Semester End Examination shall not be eligible to appear for the additional Semester End Examination.
d. The additional Semester End Examination shall be of two and half hour's duration and of 70 marks. The learner shall appear for the course of the Semester End Examination for which he/she was absent or has failed.

MODE OF CONDUCT OF SEMESTER END ADDITIONAL EXAMINATION:

a. There will be one additional examination for semester I, II, III and IV for those who have failed or remained absent.
b. The absent learner will be allowed to appear for the examination by the head of the institution after following the necessary formalities subject to the reasons to the satisfaction of the head of the institution.
c. This examination will be held 20 days after the declaration of results but not later than 40 days.

PROJECT EVALUATION

1. A learner who PASSES IN ALL THE COURSES BUT DOES NOT secures minimum grade of E in project as applicable has to resubmit a fresh project till he/she secures a minimum of grade E.
2. The credits and grade points secured by him/her in the other courses will be carried forward and he/she shall be entitled for grade obtained by them on passing of all the courses.
3. The evaluation of project and viva/voce examination shall be done by marks only and then it will be converted into grade in the Ten-point scale and award the same to the learner.

4. A learner shall have to obtain minimum of grade E (or its equivalent marks) in project evaluation and viva/voce taken together to obtain 30% marks in project work.

R.****: **Grade Cum Marks Cards:**
The result gazette and the format of the Grade Cards for the semesters conducted by colleges on behalf of the University will be uniform for all the Colleges / Institutions as indicated in the manual for the faculty.

R.*: Semester wise Credit allocation:**

course	Sem-1	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-VI	Total credit
US-CH	20	20	20	20	20	20	120

R.*** GRACING:** The gracing shall be carried out as per existing ordinances of the University in force.

R.** Question Papers Setting, Assessment Pattern:**
1. The question papers shall be set and assessed by the teacher, teaching the course. If the course is taught by more than one teacher, the question paper shall preferably be set jointly, and assessment of the sections / questions shall be done by the respective teacher.
2. The College authorities may request the teachers from other institutes teaching the course to set the question paper and/or assess the answer papers. However, for such actions the university authorities may seek proper reasons and justifications from the concerned Head of the Institute.
3. The question paper set by the college in different courses shall be forwarded to the University within 15 days of the declaration of the results for the semester for being placed before the respective Board of Studies, which shall report their observations to the Academic Council and inform the observations of the Board and the Academic Council to the concerned colleges.

R.** Centralized Assessment:**
The entire work of assessment of the answer papers at the Semester End Examinations shall be centralized within the premises of the concerned college as per the provisions of the University Act and shall be open to inspection by the University. The College can appoint a committee of 5 members to plan and conduct the CAP Center to ensure smooth, efficient, and effective conduct of CAP and Completion of the Assessment.

R.** Verification and Revaluation**:
Shall be as per the existing ordinances and regulation / & VCD of the University.

R.** Ex-student:** Learner's who are declared failed, on account of failure at the Internal Assessment and/or Semester End Examinations or who have been allowed to keep terms for the higher class shall appear as ex-student for the Internal Assessment and/or the Semester End Examination in the failed course at the examinations held by their respective college. Examination for the ex-students will be held at least 15 days prior to the Semester End Examination of the next Semester as per the pattern of the course in the respective (failed) semester examination. The examinations for the ex-students shall be held in every semester.

R.** College Examination Committee**: The College Examination Committee shall consist of not more than 10 members, nominated by the Principal / Head of the Institute. One of the members shall be the Chairman of the Committee. The Committee will act as the custodian and shall be In-charge of all the matters pertaining to the Internal Assessment, Semester End Examination of regular as well as ex-students for all the examination at Semester I to IV and for the Internal Assessment for

Semester V and VI including preparation of time table, setting of the question paper, arrangement for assessment of the answer books, the declaration of the results, attending to and resolving the grievances/queries of the learners which are not part of Unfair Means Inquiry Committee, keeping records of the assessment of all the assessments and examinations, scrutiny of the student's eligible to appear for the additional examination and any other matter pertaining to the conduct of the additional and examination for the ex-students. The committee shall work as per the rules & regulation of the University and under the superintendent of the Principal/ Head of the Institution but as per direction of University Examination authority from time to time.

R.** College Unfair Means Inquiry Committee**: The College Unfair Means Inquiry Committee as per the prevailing ordinances of the University. The term of the committee shall be for five years subject to the provision of the Maharashtra Universities Act. The proceedings and working of the committee shall be maintained in the form of documents and minutes.

R.** Sets of Question papers**: Three different sets of question papers shall be drawn with the model answer paper and assessment scheme per course for every Semester End Examination one of which shall be used for the regular examination, the second set can be used for the additional examination and the third set can be used for the examination for the ex-student. Similarly, two sets of question papers shall be drawn for every test/assignment conducted per course one of which shall be used for the examination and the other for the additional examination.

R.** Remuneration to Paper Setters / Examiners / Teaching and Non-**

Teaching Staff: The remuneration payable to the paper setters and examiners will be as prescribed by the University Statute from time to time. The remuneration payable to the teaching and non-teaching staff appointed for the conduct of the examinations will be as per the rates prescribed by the University for the conduct of the Third Year Examinations by the University in the concerned faculty.

R.**** GRACING: The gracing shall be carried out as per existing ordinances of the University in force.

O.*******: - Grace Marks passing in each head of passing:** Grace Marks passing in each course/ head of passing (Theory/ Practical/ Oral/ Sessional/ TW/ External / Semester End Exam / Internal Assessment) The examinee shall be given the benefit of grace marks only for passing in each course / head of passing (Theory / Practical / Oral / Sessional/ TW) in External / Semester End Examination or Internal Examination Assessment as follows:

Head of Passing	Grace Marks Up to
Up to - 50	2
051 - 100	3
101 - 150	4
151 - 200	5
201 - 250	6
251 - 300	7
301 - 350	8
351 - 400	9
401and above	10

Provided that the benefit of such gracing marks given in BSC courses head of passing shall not exceed 1% of the aggregate marks in that examination. Provided further that the benefit of gracing of marks under this Ordinance, shall be applicable only if the candidate passes the entire examination of semester / year. Provided further that this gracing is concurrent with the rules and guidelines of professional statutory bodies at the All-India level such as AICTE, MCI, Bar Council, CCIM, CCIH, NCTE, UGC etc.

O **** Grace Marks for getting Higher Class / Grade**

A candidate/learners who passes in all the subjects / courses and heads of passing in the examination without the benefit of either gracing or condonation rules and whose total number of marks falls short for securing Second Class / Higher Second Class/ First Class or next Higher Grade by marks not more 1% of the aggregate marks of that examination or up to 10 marks, whichever is less, shall be given the required marks to get the next higher or grade as the case may be.

O.****: - Grace Marks for getting Higher Class / Grade**

A candidate/learner who passes in all the subjects / courses and heads of passing in the examination without the benefit of either gracing or condonation rules and whose total number of marks falls short for securing Second Class / Higher Second Class/ First Class or next Higher Grade by marks not more 1% of the aggregate marks of that examination or up to 10 marks, whichever is less, shall be given the required marks to get the next higher or grade as the case may be.

Provided that benefits of above-mentioned grace marks shall not be given, if the candidate fails to secure necessary passing marks in the aggregate course / head of passing also, if prescribed, in the examination concerned.

Provided further those benefits of above-mentioned grace marks shall be given to the candidate for such examination/s only for which provision of award of Class / Grade has been prescribed.

Provided further that this gracing is concurrent with the rules and guidelines of professional statutory bodies at the All-India level such as AICTE, MCI, Bar Council, CCIM, CCIH, NCTE etc.

O.**Grace Marks for getting distinction / Grade 'O' in the subject / course only**.

A candidate/learners who passes in all the Courses or Subjects/ Heads of passing in the examination without benefit of either gracing or condonation rules and whose total number of marks in the courses/ subject/s falls short by not more than three marks for getting Grade 'O'/ distinction in the courses / subject/s respected shall be given necessary grace marks up to three (03) in maximum two subjects, courses subject to maximum 1% of the total marks of that Head of Passing whichever is more, in a given examination.

Provided that benefits of above-mentioned grace marks shall not be given to the candidate only for such examination/s for which provision for distinction in a course /subject has been prescribed.

Provided further that this gracing is concurrent with the rules and guidelines of professional statutory bodies at the All-India level. such as AICTE, MCI, Bar Council, CCIM, CCIH, NCTE etc.

O. *** Condonation**

If a candidate/learner fails in only one course/ head of passing, having passed in all other courses/ heads of passing, his/her deficiency of marks in such head of passing may be condoned by not more than 1% of the aggregate marks of the examination or 10% of the total number of marks of that

course / head of passing in which he/she is failing, whichever is less. However, condonation, whether in one head of passing or aggregate head of passing be restricted to maximum up to 10 marks only.

Condonation of deficiency of marks be shown in the Grade Card/ Statement of Marks in the form of asterisk and Ordinance number. Provided that this condonation of marks is concurrent with the rules and guidelines of professional statutory bodies at the All-India level such as AICTE, MCI, Bar Council, CCIM, CCIH, NCTE etc.

O.*** Moderation**

1. The Moderation System shall be application to all the faculties for Under Gradate and Post Graduate Semester End Examination / External Theory Examination.
2. 2.100% moderation of the answer book shall be carried out in the case of candidates failing by 10% of marks of the aggregate marks of that course / paper.
3. In case of BSc course, 100% moderation shall be carried out in case of candidates obtaining 70% and above marks or Grade 'O'.
4. The moderation of answer books of at least 5% of total number of candidates obtaining marks between Grade 'E' / minimum passing marks and marks.
5. required for Grade 'A' and above First Class/ distinction shall be carried out on random sample basis.
6. One moderator shall be appointed per five examiners. However, Chairman, Board of paper setters will act as the moderator, where there are less than five examiners.
7. Moderation work shall be carried out simultaneously with the central assessment of answer books at CAPs.
8. Where marks awarded by the moderator vary from those awarded by original examiner, the marks awarded by the moderator shall be taken as final.
9. University shall formulate detailed scheme of moderation on the basis of guidelines given above.

O.****: Vigilance Squad**

1. The Vigilance Squad/s of not less than three and not more than four members shall be appointed by the Vice Chancellor to visit the Centers of University Examinations to:
2. Ensure that the University Examinations are conducted as per norms laid down.
    a. Observe whether the Senior Supervisors and Block Supervisors are following scrupulously instructions for conduct of the University Examinations.
    b. Check the students who try to resort to malpractices at the time of University Examinations and report such case to the University.
3. The Vigilance Squad is authorized to visit any Examination Centre without prior intimation and enter office of the In-charge of the Examination Centre to check the record and other material relating to the conduct of Examination. They can enter in any block of Examination for checking the candidates identify card, fee receipt, hall tickets etc. to ascertain the authenticity of the Candidate. The Vigilance Squad shall e authorized to detect use of malpractices and unfair means in the University Examination.
4. The Vice Chancellor shall appoint Vigilance Squad which may include: Senior Teachers of Affiliated College/Recognized Institution/ University Departments /Teachers and desirably one lady teacher; and any other person as the Vice Chancellor considers appropriate.
5. The Chairman of Vigilance Squad/s shall submit the report on surprise visit directly to the Vice Chancellor with a copy to the concerned Principal. The Vigilance Squad/s may make suggestions in the matter of proper conduct of examinations, if necessary.
6. The Principal of the College where the centre of examination is located shall be responsible for the smooth conduct of examination. He/ She shall ensure strict vigilance against the use of unfair

means by the students and shall be responsible for reporting such cases to the University as well as the law of enforcing authority.

O. ******Amendments of Results

1. **Due To Errors** In any case where it is found that the result of an examination has been affected by errors, the Controller of Examinations shall have power to amend such result in such manner as shall be in accordance with the true position and to make such declaration as is necessary, with the necessary approval of Vice Chancellor, provided the errors are reported / detected within 6 months from the date declaration of results. Errors detected thereafter shall be placed before the Board of Examinations.
2. Error Means:-
   i) Error in computer/data entry, printing or programming and the like.
   ii) Clerical error, manual, or machine, in totaling or entering of marks on ledger/register.
   iii) Error due to negligence or oversight of examiner or any other person connected with evaluation, moderation, and result preparation.
3. Due to fraud, malpractices etc.
4. In any case where the result of an examination has been ascertained and published and it is found that such result has been affected by any malpractices, fraud or any other improper conduct whereby an examinee has benefited and that such examinee, has in the opinion of the Board of Examination been party of privy to or connived at such malpractice, fraud or improper conduct, the Board of Examination shall have power at any time notwithstanding the issue of the Certificate or the award of a Prize or Scholarship, to amend the result of such examinee and to make such declaration as the Board of Examination considers necessary in that behalf

HSNC University Mumbai
(2021-2022)

Ordinances and Regulations
With Respect to

Credit Based Semester and Grading System
(CBSGS)

For the Programmes

Under

The Faculty of Science and Technology

In the subject of

CHEMISTRY

With effect from the Academic year 2021-2022

Preamble:
Chemistry is the study of matter and the chemical reactions between substances. It also involves the study of composition, structure, and properties of matter. Sub-domains of Chemistry include Analytical chemistry, Biochemistry, Inorganic chemistry, Organic chemistry, Physical chemistry, and Biophysical chemistry. The study of Chemistry can be organized into distinct branches that emphasize subsets of chemical concepts. Analytical Chemistry seeks to determine the exact chemical compositions of substances.

Biochemistry is the study of chemicals found in living things (such as DNA and proteins). Inorganic chemistry studies substances that do not contain carbon. Organic chemistry studies carbon-based substances. Physical chemistry is the study of the physical properties of chemicals. Biophysical chemistry is the application of physical chemistry in a biological context because it bridges physics with other natural sciences, such as geology and biology.

Chemistry is the central science and impacts on all facets of our lives. An understanding of Chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whether it be breathing or baking a cake, driving a car or listening to a battery driven mini disk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21stcentury. A Chemistry-based degree gives excellent qualification for a wide career choice within science industry or commerce.

The S. Y. B. Sc Chemistry syllabus US-SCH is a Choice based credit system comprising of three papers having three units each in both the semesters.

The current course is designed to enhance the Knowledge of the subject. While designing of the syllabus care has been taken to balance the fundamentals of Chemistry with some advance techniques Chemistry which would give the stakeholders an edge over the others.

The course would give the students option to develop skills in areas which have direct relevance to employability in diagnostics, health, food and pharmaceutical industries, agriculture, and environment-related job opportunities in Chemistry.

S. Y. B. Sc CHEMISTRY SYLLABUS - SEMESTER-III

Summary

Sr. No.	Choice Based Credit System			Subject Code	Remarks
1	Core Course Chemistry			**US-SCH-301 US-SCH-302 US-SCH-303 USSCH3PA USSCH3PB USSCH3PC**	
2	Elective Course	Discipline Specific Elective (DSE) Course			
		2.1	Interdisciplinary Specific Elective (IDSE) Course		
		2.2	Dissertation/Project		
		2.3	Generic Elective (GE) Course		
3	Ability Enhancement Courses (AEC)				
4	Skill Enhancement Courses (SEC)				

Detail Scheme

SN.	**Subject Code**	**Subject Title**	**Periods Per Week**					**Credit**	**Seasonal Evaluation Scheme**				**Total Marks**
			Units	**SL**	**L**	**T**	**P**		**S.L.E**	**CT**	**TA**	**SEE**	
1	**US-SCH-301**	**Physical, Inorganic, Organic Chemistry**	3	20 %	3	0	0	2	10	20	10	60	100
2	**US-SCH-302**	**Physical, Inorganic, Organic Chemistry**	3	20 %	3	0	0	2	10	20	10	60	100
3	**US-SCH-303**	**Analytical Chemistry**	3	20 %	3	0	0	2	10	20	10	60	100
4	**USSCH3 PA**	**Physical and Analytical Chemistry(Practicals)**	-	-	3	-	9	1	-	-	-	50	50
5	**USSCH3 PB**	**Inorganic and Analytical Chemistry(Practicals)**	-	-	3	-		1	-	-	-	50	50
6	**USSCH3 PC**	**Organic and Analytical Chemistry(Practicals)**	-	-	3	-		1	-	-	-	50	50
	Total Hours / Credit							**9**	**Total Marks**				**450**

2nd Year Semester – III Units – Topics – Teaching Hours

Course code	Title	Credits	Total Marks
Paper I Theory	**PHYSICAL, INORGANIC, ORGANIC CHEMISTRY**	**2 credits (45 lects)**	**100 (60+40)**
Unit I	**1.1 Chemical Thermodynamics (8L)** **1.1.1** Free energy functions: Helmholtz Free Energy, Gibb's Free energy, variation of Gibb's free energy with pressure and Temperature. Gibb's-Helmholtz equation**(2L)** **1.1.2** Thermodynamics of open system: partial molal properties, Chemical Potential and its Variation with Pressure and Temperature, Gibb's Duhem equation. **(2L)** **1.1.3** Concept of Fugacity and Activity. **(2L)** **1.1.4** Van't Hoff Reaction Isotherm and Van't Hoff Reaction Isochore. (Numerical expected). **(2L)** **1.2 Electrochemistry (7 L)** **1.2.1** Conductivity, Equivalent and Molar Conductivity and their Variation with Dilution for weak and strong electrolytes. **(2L)** **1.2.2** Kohlrausch's Law of Independent Migration of ions.(numerical expected) **(1L)** **1.2.3** Application of conductance Measurements; determination of Degree of ionization constant of weak electrolyte, solubility and solubility product of sparingly soluble salts (Numerical expected). **(2L)** **1.2.4** Transference Number and its experimental Determination using Moving Boundary Method (Not required Numerical Expected). Factors Affecting Transference Number. **(2L)**	15 lectures	
Unit II	**Chemical Bonding** **2.1** Non-Directional Bonding (4L) 2.1.1 Ionic Bond: Conditions for the Formation of Ionic Bond, Properties of ionic bond 2.1.2 Lattice Energy, Borne-Lande Equation 2.1.3 Kapustinskii Equation 2.1.4 Born-Haber Cycle and its Application. **2.2.** Directional Bonding: Orbital Approach. (5L) 2.2.1 Covalent Bonding, The Valence Bond Theory- Introduction and basic tenets. 2.2.2 Interaction between two hydrogen atoms and the Potential energy diagram of the resultant system. 2.2.3 Corrections applied to the system of two hydrogen atoms- Formation of H_2 2.2.4 Homonuclear diatomic molecules from He2 to Ne2 2.2.5 Resonance and the concept of Formal Charge; Rules for Resonance or Canonical structures. 2.2.6 Bonding in Polyatomic Species: The role of Hybridization. And types of hybrid orbitals-sp, sp2, sp3, sp3d, sp2d2and sp2d sp3d2.	15 lectures	

	2.2.7 Equivalent and Non-Equivalent hybrid orbitals 2.2.8 Contribution of a given atomic orbital to the hybrid orbitals (w.r.t. sp3 hybridisation as in CH_4, NH_3 and H_2O and series like NH_3, PH_3, AsH_3, BiH_3) **2.3 Molecular Orbital Theory (6L)** 2.3.1. Introduction to basic principle of MOT, Comparing Atomic Orbitals and Molecular Orbitals. 2.3.2. Linear combination of atomic orbitals. to give molecular orbitals LCAO- MO approach for diatomic homonuclear molecules with examples and heteronuclear diatomic (HCl) 2.3.3. Wave mechanical treatment for molecular orbitals (H2+ and H2) 2.3.4. Molecular orbital Theory and Bond Order and magnetic property. (Problems and numerical problems expected wherever possible)		
Unit III	**3.1 Reactions and reactivity of halogenated hydrocarbons: [4L]** 3.1.1 Alkyl and aryl halides Alkyl halides: Nucleophilic substitution reactions: SN1, SN2 and SNi mechanisms with stereochemical aspects and factors affecting nucleophilic substitution reactions-nature of substrate, solvent, nucleophilic reagent and leaving group. Aryl halides: Reactivity of aryl halides towards nucleophilic substitution reactions. Nucleophilic aromatic substitution (SNAr) addition-elimination mechanism and benzyne mechanism. **3.1.2.Organometallic compounds: [3L]** Nomenclature, nature, type and reactivity of carbon-metal bond. Preparation of Grignard reagents using alkyl / aryl halide. Structure, stability, and reactions with compounds containing acidic hydrogen, carbonyl compounds, CO2, cyanides and epoxides. Applications of Wilkinson's catalyst. **3.2 Alcohols and phenols: [8L]** 3.2.1. Alcohols: Nomenclature, Preparation: Hydration of alkenes, hydrolysis of alkyl halides, reduction of aldehydes and ketones, using Grignard reagent. Properties: Hydrogen bonding, types, and effect of hydrogen bonding on different properties. Acidity of alcohols, Reactions of alcohols 3.2.2.Phenols: Preparation, physical properties, and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols.	15 lectures	
Paper 2 Theory	**PHYSICAL, INORGANIC, ORGANIC CHEMISTRY**	**2 credits (45 lects)**	**100 (60+40)**
Unit I	**1.1 Chemical Kinetics (7L)** **1.1.1** Types of complex reactions: Reversible or Opposing consecutive and Parallel Reactions (No derivations, only examples expected). **(1L)**	15 lectures	

	1.1.2 Thermal Chain reactions: H. and Br. Reaction (only steps involved, no kinetic expression expected) **(1L)** **1.1.3** Effect of Temperature on the Rate of Reaction (exothermic and endothermic), Concept of Energy of Activation (Ea), Arrhenius equation. (Numerical expected). **(3L)** Theories of Reaction rates: Collision Theory for Unimolecular (Lindemann Theory) and Bimolecular Reaction (derivation expected). Activated Complex Theory. Comparison between the two theories. **(2L)** **1.2 Solutions (8L)** **1.2.1** Thermodynamics of Ideal Solutions: Ideal solutions and Raoult's Law, Deviations from Raoult's Law-Non-ideal solutions. Vapour Pressure- Composition and Temperature – composition curves of Ideal and Non-Ideal solutions. **(3L)** **1.2.2** Partial Miscibility of Liquids: critical Solution Temperature; Effect of Impurity on Partial Miscibility of Liquids with Respect to Phenol-Water, triethanolamine- Water and Nicotine- Water Systems. **(2L)** **1.2.3** Immiscibility of liquids- Principle of Steam Distillation.(Numerical expected). **(2L)** Introduction to Nernst Distribution Law and its limitations. **(1L)**		
Unit II	**Selected topics on p block elements (15L)** **2.1 Chemistry of Boron compounds** 2.1.1 Electron deficient compounds – BH_3, BF_3, BCl_3 with respect to Lewis acidity and applications. 2.1.2 Preparation of simple boranes like diborane 2.1.3 Structure and bonding in diborane and tetraborane (2e-3c bonds) 2.1.4 Preparation, properties, structure and uses of the following compounds: A) Borax & B) Borazine **2.2 Chemistry of Silicon and Germanium** 2.2.1 Silicon compounds: Occurrence , Structure and inertness of SiO_2 2.2.2 Preparation , Properties & structure of a) $SiCl_4$ b) Silicates 2.2.3 Preparation of extra pure Silicon and Germanium **2.3 Chemistry of Nitrogen family** 2.3.1 Trends in chemical reactivity - Formation of hydrides, halides, oxides with special reference to oxides of nitrogen. 2.3.2 Oxides of nitrogen with respect to preparation and structure of NO, NO_2, N_2O and N_2O_4. 2.3.3 Synthesis of ammonia by Bosch – Haber process. Synthesis of HNO_3	15 lectures	
Unit III	**Carbonyl Compounds and Crown ethers: [15L]** 3.1 Nomenclature of aliphatic, alicyclic and aromatic carbonyl compounds. Structure, reactivity of aldehydes and ketones and methods of preparation; Oxidation of primary and secondary alcohols using PCC, hydration of alkynes, action of Grignard reagent on esters, Rosenmund reduction, Gattermann – Koch formylation and Friedel Craft acylation of	15 lectures	

	arenes. 3.2 Reactions of aldehydes and ketones with $NaHSO_3$, HCN, RMgX, alcohol, amine, phenyl hydrazine, 2,4-Dinitrophenyl hydrazine. 3.3 Mechanisms of following reactions: Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Cannizzaro and Perkin reaction. 3.4 Keto-enol tautomerism: Mechanism of acid and base catalysed enolization 3.5 Active methylene compounds: Acetylacetone, ethyl acetoacetate diethyl malonate, stabilised enols. Reactions of Acetylacetone and ethyl acetoacetate (alkylation, conversion to ketone, mono- and dicarboxylic acid) 3.6 Cr**own** ethers: Introduction, nomenclature, structure and applications of crown ethers.		
Paper 3 Theory	**ANALYTICAL CHEMISTRY**	**2 credits (45 lects)**	**100 (60+40)**
Unit I	**Quality in Analytical Chemistry (15L)** **1.1** Language of analytical chemistry: Scope and importance of analytical chemistry, Important terms – analysis, determination, estimation, method, procedure, protocol. (3L) **1.2** Types of analysis: Based on information generated (Proximate, Partial, Trace, Complete analysis), Based on size of sample (Macro, semi micro, micro, ultra-micro, and trace), based on method of analysis (classical & instrumental). (3L) **1.3** Concept of quality: QA and QC, Importance of quality concept in industry, Various grades of laboratory materials, Chemical standard, and certified reference materials. (4L) **1.4** Errors: Accuracy, Precision, Error in measurement, types of errors – determinate and indeterminate errors, Correction of determinate errors, % error (Numerical problems expected on %error) (5L)	15 lectures	
Unit II	**Classical method of analysis – I: Titrimetric analysis (15L)** **2.1 Titrimetric analysis:** Types of titrations (neutralization, precipitation, complexometry and redox) with example, Calibration of volumetric apparatus (burette, pipette, Standard flask etc.) used in titrations. Basic requirements of Titrimetric analysis like standard solution and indicator. (3L) **2.2 Neutralization titration:** Recap of strong acid vs. strong base (Sem. 2) titration curve, Theory of acid base indicator, Correlation of Correlation of pK in value and color change of indicator. Generation of titration curve for titration of strong acid (HCl) vs weak base (NH4OH) and Weak acid (CH3COOH) vs Strong Base (NaOH). (7L)	15 lectures	

	2.3 Precipitation titration: recap of Solubility product concept (Sem. 2), Understanding titration of silver ions with halide solution (argentometric titration), Titration curve of argentometric titration, End point determination in precipitation titration – Mohr's method in detail and Volhard's method, Fajan's method (only introduction). (5L) [Numerical problems expected on this unit based on 2.2 and 2.3Mohr's method]		
Unit III	**Instrumental analysis - I (15L)** **3.1 Basic concept:** Relation between analyte, stimulus and measurement of signal, block diagram of analytical instrument, types of analytical instruments (Optical Instruments, Electro-analytical instruments, thermal instruments etc.) (4L) **3.2 Optical instruments (Colorimetry and Spectrophotometry):** 3.2.1 Concept of absorption and emission, Basic terms like Radiant power, Absorbance, Transmittance, Monochromatic light, Polychromatic light, absorptivity etc. Types of titrations (neutralization, precipitation, complexometry and redox) with example, Calibration of volumetric apparatus (burette, pipette, Standard flask etc.) used in titrations. Basic requirements of Titrimetric analysis like standard solution and indicator. (3L) 3.2.2 Statement of Beer's Law and Lambert's law, Combined mathematical expression of Beer-Lambert's Law, deviations and validity of Beer – Lambert's Law (real deviation, instrumental deviation and chemical deviation). [Numerical problems expected on Beer – Lambert's Law] (4L) 3.2.3 Instrumentation for absorption spectroscopy: Colorimeter and spectrophotometer block diagram single beam and double beam spectrophotometer (Principle, construction, working and role of each component). Types and comparison of sample holders, Monochromators, detectors etc. components (4L) 3.3.3 Applications of UV and Visible spectrophotometry – qualitative and quantitative analysis, photometric titration (principle, Types and examples). Advantages of spectrophotometer over colorimeter. (4L)	15 lectures	
PRACT -A	**PHYSICAL AND ANALYTICAL CHEMISTRY**	**1 credit (45 lects)**	**50**
PRACT -B	**INORGANIC AND ANALYTICAL CHEMISTRY**	**1 credit (45 lects)**	**50**
PRACT C	**ORGANIC AND ANALYTICAL CHEMISTRY**	**1 credit (45 lects)**	**50**

- **45 Lectures equivalent to 33.75 hours**
- **One Credit =16.87 hours equivalent to 17 Hours**
- **Curriculum Topics along with Self-Learning topics - to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT**

Self-Learning topics US-SCH-301:

Topic	Online resource
Van't Hoff's reaction isotherm Van't Hoff's reaction isochores Transport number	**https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwj4kNvThMDxAhXJdCsKHe8HC9MQwqsBMA16BAgyEAE&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DyreXLWECD-Y&usg=AOvVaw0phGtun72pkmXLDkb3S-fF** **https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjCrJL1hMDxAhVYAXIKHeHKBrYQFjABegQIAhAD&url=https%3A%2F%2Fwww.oxfordreference.com%2Fview%2F10.1093%2Foi%2Fauthority.20110803115212235&usg=AOvVaw0SJMoln7eqSn_vTpHszbWH**
Types of Ionic Crystals	https://youtu.be/XXcssYUYCps
SN1 and SN2 reactions	https://youtu.be/TnY1S5IdVqI

Self-Learning topics US-SCH-302:

Topic	Online resource
Effect of Temperature on Rate of reaction (exothermic and endothermic) and concept of energy of activation	https://www.unf.edu/~michael.lufaso/chem2046H/2046chapter14.pdf
Partial Miscibility of Liquids: Water and Nicotine- Water Systems	https://www.youtube.com/watch?v=Aq9nwMb_5Ag
Synthesis of ammonia by Bosch – Haber process	https://youtu.be/A8K-61sk14E
Preparation of carbonyl compounds using Grignard reagent and their reactions with Grignard reagents, Claisen-Schmidt reaction, Perkin reaction, Friedel Crafts acylation.	https://nptel.ac.in/courses/104/103/104103110/

Self-Learning topics US-SCH-303

Topic	Online resource
1.2 Types of analysis: Based on information generated (Proximate, Partial, Trace, Complete analysis), Based on size of sample (Macro, semi micro, micro, ultra micro and trace), based on method of analysis (classical and instrumental).	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi81enTo7fxAhXQ4XMBHRA5AH4QFjAKegQIHRAD&url=https%3A%2F%2Fwww.britannica.com%2Fscience%2Fquantitative-chemical-analysis&usg=AOvVaw01QxtI9ufxrJdo4Yo tb50k. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi81enTo7fxAhXQ4XMBHRA5AH4QFjAPegQIExAD&url=https%3A%2F%2Fopentextbc.ca%2Fchemistry%2Fchapter%2F4-5-quantitative-chemicalanalysis%2F&usg=AOvVaw2XD gu1r_gS7co_9Cy p me0x

2.3 End point determination in precipitation titration – Mohr's method in detail and Volhard's method, Fajan's method (only introduction).	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwijiLaZpbfxAhXCW3wKHTHZCIgQFjALegQIIBAD&url=https%3A%2F%2Fchem.libretexts.org%2FBookshelves%2FAnalytical_Chemistry%2FBook%253A_Analytical_Chemistry_2.1_(Harvey)%2F09%253A_Titrimetric_Methods%2F9.05%253A_Precipitation_Titrations&usg=AOvVaw1wKgFFs9i0Y19iXpUQcv5w https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwijiLaZpbfxAhXCW3wKHTHZCIgQFjAMegQIHhAD&url=https%3A%2F%2Fbyjus.com%2Fchemistry%2Fprecipitation-titration%2F&usg=AOvVaw0JkVuiV7crydVWROSKLbgS
3.3 Photometric titration: principle, Types and examples	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiylOHppbfxAhU2FLcAHeHZBt4QFjAAegQIAhAD&url=https%3A%2F%2Fonlinelibrary.wiley.com%2Fdoi%2Fpdf%2F10.1002%2Fjps.2600530502&usg=AOvVaw2P36luE-K1Sh2zXAGTHePU https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiylOHppbfxAhU2FLcAHeHZBt4QFjAJegQIJhAD&url=https%3A%2F%2Fchem.libretexts.org%2FCourses%2FProvidence_College%2FCHM_331_Advanced_Analytical_Chemistry_1%2F09%253A_Applications_of_Ultraviolet-Visable_Molecular_Absorption_Spectrometry%2F9.05%253A_Photometric_and_Spectrophotometric_Titrations&usg=AOvVaw2CRn5ddOWGYuDSaUNzJDhD

PRACTICALS (3credits)	
Practical A	
hysical and Analytical Chemistry	**Instrumental** 1. To verify the Ostwald's dilution law for weak acid conductometrically 2. To study the equivalence point of Strong acid /weak acid by conduct metric titration. 3. Estimation of Iron (II) in the given solution by titrating against Potassium Dichromate Potentiometrically and to calculate the amount of Fe2+ Present. 4. To determine the solubility of sparingly salt (any two) conductometrically 5. To verify Beer Lambert's law **Non Instrumental** 1. To investigate the reaction between $K_2S_2O_8$ and KI with equal initial concentrations of reactants.
Practical B	
Inorganic Chemistry	1. Determination of amount of aluminum in the given solution of potash alum. 2. Determination of percentage purity of boric acid using supplied sodium

Analytical Chemistry	hydroxide. 3. Estimation of Ni as Ni-DMG complex by gravimetry (Counterpoise method). 4. Estimation of Ba as $BaCrO_4$ by gravimetry (Ignition using filter paper). 5. Estimation of volume strength of H_2O_2 using $KMnO_4$ **Inorganic preparations (minimum 3 to be done)** 1. Tetramine Cu (II) sulphate. 2. Hexamine Ni (II) chloride. 3. Preparation of sodium cuprous thiosulphate. 4. Preparation of potassium trioxalato ferrate (III).
Practical C	
Organic and Analytical Chemistry	**Organic spotting and derivatives** Derivatives to be prepared 1. Acetone to Iodoform 2. Salicyclic acid to Methyl salicylate 3. Cyclohexanone to cyclohexanoneoxime 4. Benzamide to benzoic acid

S. Y. B. Sc CHEMISTRY SYLLABUS - SEMESTER-IV

Summary

Sr. No.	Choice Based Credit System			Subject Code	Remarks
1	Core Course Chemistry			**US-SCH-401 US-SCH-402 US-SCH-403 USSCH4PA USSCH4PB USSCH4PC**	
2	Elective Course	Discipline Specific Elective (DSE) Course			
		2.1	Interdisciplinary Specific Elective (IDSE) Course		
		2.2	Dissertation/Project		
		2.3	Generic Elective (GE) Course		
3	Ability Enhancement Courses (AEC)				
4	Skill Enhancement Courses (SEC)				

Detail Scheme

SN.	Subject Code	Subject Title	Periods Per Week					Credit	Seasonal Evaluation Scheme				Total Marks
			Units	SL	L	T	P		S.L.E	CT	TA	SEE	
1	US-SCH-401	Physical, Inorganic, Organic Chemistry	3	20 %	3	0	0	2	10	20	10	60	100
2	US-SCH-402	Physical, Inorganic, Organic Chemistry	3	20 %	3	0	0	2	10	20	10	60	100
3	US-SCH-403	Analytical Chemistry	3	20 %	3	0	0	2	10	20	10	60	100
4	USSCH4PA	Physical and Analytical Chemistry(Practicals)	-	-	3	-	9	1	-	-	-	50	50
5	USSCH4PB	Inorganic and Analytical Chemistry(Practicals)	-	-	3	-		1	-	-	-	50	50
6	USSCH4PC	Organic and Analytical Chemistry(Practicals)	-	-	3	-		1	-	-	-	50	50
	Total Hours / Credit							9	Total Marks				450

2nd Year Semester – IV Units – Topics – Teaching Hours

Course code	Title	Credits	Total Marks
Paper 1 Theory	**PHYSICAL, INORGANIC, ORGANIC CHEMISTRY**	**2 credits (45 lects)**	**100 (60+40)**
Unit I	**1.1 Nuclear Chemistry (8L)** 1.1.1 **Radioactivity in Nature:** Discovery of Radioactivity, Radioactive Substances in Nature **(1L)** 1.1.2 **Radioelements, Isotopes and Radionuclides:** Isobars, Isotopes and Isotones of the elements with the help of the Periodic Table and the Chart of the Nuclides, Stability and Transmutation of Nuclides, Binding Energies and mass defects of Nuclei **(2 L)** 1.1.3 **Decay Modes & Nuclear Radiation:** Alpha-Decay, Beta-Decay, Gamma-Transitions. General Properties of Alpha Radiation, Beta Radiation and Gamma Radiation. **(2L)** 1.1.4 **Radioactive Decay:** Decay Series and Decay constant, Law and Energy of Radioactive Decay, Radioactive Equilibria, Secular Radioactive Equilibrium, Transient Radioactive Equilibrium, Half-life and Average life of radioactive elements. (Numerical expected). **(3 L)** **1.2 Phase equilibria (7 L)** 1.2.1 Phases, Components and Degrees of Freedom of a System Criteria of Phase Equilibrium. Gibbs Phase Rule and its Thermodynamic derivation. **(1 L)** 1.2.2 Phase Diagrams of One-component systems (Water and sulphur) **(2 L)** 1.2.3 Two Component Systems Involving Eutectics (Lead-silver system)., Congruent Melting Point Zinc Magnesium System. Incongruent melting point sodium-potassium system. **(2 L)** 1.2.4 Three component Systems: Introduction, Graphical representation, Phase Diagram for three liquids forming one immiscible pair (water, acetic acid and chloroform) **(2L)**	15 lectures	
Unit II	**2.1 Transition metals (9 L)** **2.1.1** Position in the periodic table; Natural occurrence principal ores and minerals; A brief discussion of differences between the first, second and third transition series. **2.1.2** Significance of special stability of d^0, d^5 and d^{10} leading to variable oxidation states; Unusual oxidation states and their stabilities in aqueous with special reference to vanadium, and chromium.) **2.1.3** Origin of colour for transition metals and their compounds: such as reflectivity, surface coatings, particle size, packing density for metals and nature of d-orbitals, number of electrons in the d-orbitals, geometry, and ability for charge transfer).	15 lectures	

	2.1.4 Magnetic properties of transition metal compounds: Origin of magnetism-spin and orbital motion of electrons; equation for spin only and spin-orbital magnetism in terms of Bohr magnetons (No derivation of relevant equations expected); Reasons for quenching of orbital moments. **2.1.5** Chemistry of Titanium and vanadium: properties of Oxides and chlorides; use in titrimetric analysis**.** **2.1.6** Qualitative tests for transition metal ions: General considerations in devising tests (with reference to Chromium, Manganese, iron, Cobalt Nickel and Copper) **2.2 Coordination Chemistry: (6 L)** **2.2.1 Introduction to Chemistry of Coordination Compounds** i. Recapitulation of coordination compounds ii. Basic terms and nomenclature. iii. Types of ligands iv. Isomerism :General Types with special reference to isomerization, ionization,hydrate, linkage and coordination v. Evidence for the formation of coordination compounds **2.2.2.** Theories of coordination compounds i. Werner's Theory of coordination compounds, ii. Effective atomic number rule. iii. Eighteen electron Rule **2.2.3.** Nature of the Metal-Ligand Bond: i. Valence Bond Theory; Hybridisation of central metal orbitals - sp^3, sp^3d^2/d^2sp^3, sp^2d ii. Inner and outer orbital complexes of (suitable examples of Mn(II) Fe(II), Fe(III), Co(II) / Co(III), Ni(II), Cu(II) Zn(II) complexes with ligands like aqua, ammonia CN^- and halides may be used) iii. Limitations of V.B.T **2.2.4.** Application of coordination compounds.		
Unit III	**3.1 Carboxylic Acids and their Derivatives :[8L]** 3.1.1. Nomenclature, structure and physical properties, acidity of carboxylic acids, effects of substituents on acid strength of aliphatic and aromatic carboxylic acids. 3.1.2. Preparation of carboxylic acids: oxidation of alcohols and alkyl benzene, carbonation of Grignard and hydrolysis of nitriles. 3.1.3. Reactions: Acidity, salt formation, decarboxylation, Reduction of carboxylic acids with LiAlH4, diborane, Hell-Volhard-Zelinsky reaction, Conversion of carboxylic acid to acid chlorides, esters, amides and acid anhydrides and their relative reactivity. 3.1.4. Mechanism of nucleophilic acyl substitution and acid-catalysed nucleophilic acyl substitution. Interconversion of acid derivatives by nucleophilic acyl substitution. 3.1.5. Mechanism of Claisen condensation and Dieckmann condensation. **3.2 Sulphonic acids: [4L]**	15 lectures	

	Nomenclature, preparation of aromatic sulphonic acids by sulphonation of benzene (with mechanism), toluene and naphthalene, Reactions: Acidity of arene sulfonic acid, Comparative acidity of carboxylic acid and sulfonic acids. Salt formation, desulphonation. Reaction with alcohol, phosphorous pentachloride, IPSO substitution. **3.3 Stereochemistry:[3L]** Recapitulation and stereochemistry of mono and dialkyl cycloalkanes with their relative stabilities.		
Paper 2 - Theory	**PHYSICAL, INORGANIC, ORGANIC CHEMISTRY**	**2 credits (45 lects)**	**100 (60+40)**
Unit I	**1.1 Solid State (8L)** **1.1.1** Introduction to Laws Crystallography. **(1 L)** **1.1.2** Characteristics of Simple Cubic, Face Centred Cubic and Body centred Cubic Systems, Interplanar Distance in Cubic Lattice (only expression for ratio of interplanar distances are expected). **(2 L)** **1.1.3** Use of X-rays in the study of Crystal Structure, Bragg's equation (Derivation Expected), X-rays Diffraction Method of Studying Crystal Lattice Structure. (Numerical expected) **(3L)** **1.1.4** Structure of NaCl and KCl. Determination of Avogadro's number (Numerical expected)**. (2L)** **1.2 Catalysis (7L)** **1.2.1** Types of Catalysis, Catalytic Activity, Specificity and Selectivity, Inhibitors, Catalyst Poisoning and Deactivation. **(2L)** **1.2.2** Mechanism and Kinetics of Acid-Base Catalysed Reactions, effect of pH. **(2L)** **1.2.3** Mechanism and Kinetics of Enzyme catalysed Reactions (Michaelis-Menten equation). **(2L)** **1.2.4** Effect of Particle size and Efficiency of Nanoparticles as catalyst. **(1L)**	15 lectures	
Unit II	**2.1 Ions in aqueous medium** **2.1.1** Acidity of Cations and Basicity of Anions i. Hydration of Cations; Hydrolysis of Cations predicting degree of hydrolysis of Cations- ii. effect of Charge and Radius. iii. Classification of cations on the basis of acidity category – Nonacidic, Moderately acidic, strongly acidic, very strongly acidic with pKa values range and examples iv. Hydration of Anions; Effect of Charge and Radius; Hydration of anions- concept, diagram classification on the basis of basicity 2.2. **Non-aqueous Solvents** Physical properties of a solvent, types of solvents and their general characteristics, Reactions in non-aqueous solvents with reference to liquid NH3	15 lectures	

	2.3. **Uses and Environmental Chemistry of volatile Oxides and oxo-acids** A) Physical properties of concentrated oxo-acids like sulfuric, Nitric and Phosphoric acid B) Uses and environments aspects of these acids		
Unit III	**Nitrogen containing compounds: [7L]** **3.1 Amines:** Nomenclature, effect of substituent on basicity of aliphatic and aromatic amines; **3.1.1. Preparation:** Reduction of aromatic nitro compounds using catalytic hydrogenation, chemical reduction using Fe-HCI, Sn-HCl, Zn-acetic acid, reduction of nitriles, ammonolysis of halides, reductive amination, Hofmann bromamide reaction. **3.1.2. Reactions** Salt Formation, N-acylation, N-alkylation, Hofmann's exhaustive methylation (HEM), Hofmann-elimination reaction, reaction with nitrous acid, carbylamine reaction, Electrophilic substitution in aromatic amines: bromination, nitration, and sulphonation. **3.2 Diazonium Salts:** Preparation and their reactions/synthetic application, Sandmeyer reaction, Gattermann reaction, Gomberg reaction, Replacement of diazo group by -H,-OH. Azo coupling with phenols, naphthols and aromatic amines, reduction of diazonium salt to aryl hydrazine and hydrazobenzene. **3.3 Heterocyclic Compounds: [8L]** 3.3.1. Classification, nomenclature, electronic structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom. 3.3.2. Synthesis of Furan, Pyrrole, Thiophene (Paal-Knorr synthesis) and Synthesis of Pyridine (Hantzsch synthesis). 3.3.3. Reactivity of furan, pyrrole and thiophene towards electrophilic substitution reactions on the basis of stability of intermediate and of pyridine on the basis of electron distribution. Reactivity of pyridine towards nucleophilic substitution on the basis of electron distribution. 3.3.4. Reactions of furan, pyrrole and thiophene: halogenation, nitration, sulphonation, Vilsmeier-Haack reaction, Friedel-Crafts reaction. Furan: Diels-Alder reaction, Ring opening. Pyrrole: Acidity and basicity of pyrrole. Comparison of basicity of pyrrole and pyrrolidine. 3.3.5. Pyridine: Basicity, Comparison of basicity of pyridine, pyrrole and piperidine. Sulphonation of pyridine (with and without catalyst), reduction and action of sodamide (Chichibabin reaction).	15 lectures	
Paper 3 - Theory	**ANALYTICAL CHEMISTRY**	**2 credits (45 lects)**	**100 (60+40)**
Unit I	**Methods of separation- I (15L)** **1.1 Analytical separation:** Introduction and importance of analytical separation, Types of separation methods based on	15 lectures	

	solubility (Precipitation, filtration, crystallization), Gravity (centrifugation and its types), Volatility (Distillation and its types), electrical effect (electrophoresis and its types), retention capacity (Chromatography and its types), Distribution ratio (solvent extraction), exchange capacity (ion exchange) etc. (3L) **1.2 Solvent extraction:** (12L) **1.2.1** Introduction, Nernst distribution law, Distribution constant **1.2.2** Conditions of extraction - equilibrium time, solvent volume, temperature, pH etc. **1.2.3** Single step and multi-step extraction, percentage extraction for single and multi-steps, separation factor. **1.2.4** Batch and continuous extraction (Craig's counter current apparatus, Separating solvent lighter / heavier than the aqueous phase) **1.2.5** Factors affecting extraction: chelation, Ion pair formation and solvation. **1.2.6** Solid phase extraction: principal process and applications. **1.2.7** Comparison of solid phase extraction and solvent extraction.		
Unit II	**Instrumental analysis – II (Electrochemical methods of analysis) (15L)** **2.1 Potentiometry: (5L)** **2.1.1** Principle and instrumentation **2.1.2** Types of electrodes – reference electrode, working or indicator electrode (metal wire electrode and quinhydrone electrode). **2.1.3** Application of Potentiometry in neutralization titration of strong acid against strong base. Potentiometric titration curve and determination of equivalence point. **2.2 pH metry: (5L)** **2.2.1** Principle of pH metry and glass electrode as working electrode. **2.2.2** Construction of combined pH electrode . **2.2.3** Various types of pH meters. 2.2.4 Application of pH metry in neutralization titration, biological and environmental analysis. **2.3 Conductometry: (5L)** **2.3.1** Principle of conductometry **2.**3.1 Conductivity cell design and cell constant **2.**3.3 Types of conductometric titrations and titration curve. (Strong acid vs strong base, Strong acid vs weak base, weak acid vs strong base, weak acid vs weak base and mixture of strong acid and weak acid vs strong base). **2.**3.4 Advantages and limitations of conductometric titrations.	15 lectures	
Unit III	**3.1 Classical method of analysis – II: Gravimetric analysis (7L)** **3.1.1** Introduction and types (volatilization, precipitation, electro and thermo gravimetry) of gravimetric analysis. 3.1.2 Precipitation gravimetry: Steps involved in precipitation	15 lectures	

	gravimetry, Conditions of precipitation, Completion of precipitation. 3.1.3 Importance of various steps like formation of precipitation, Digestion, Filtration, washing, drying, ignition of precipitate. 3.1.4 Applications of gravimetric analysis: determination of sulfate in organic compounds, estimation of nickel in cupro-nickel alloy (Ni-DMG) and determination of Al as Al_2O_3. **3**.2 **Statistical Treatment of Analytical data**: (8L) **3.2.1 Measures of central tendencies:** Mean, Mode, Median, Average **3**.2.2 **Measures of dispersing tendencies:** deviation, standard deviation, variance etc. **3**.2.3 Distribution of random error, Gaussian distribution curve, Equation and salient features of Gaussian distribution curve. **3**.2.4 Rejection of doubtful result: 2.5d and 4.0d rule **3**.2.5 Graphical representation of data and obtaining best fitting straight line using method of average (Line equations y = mx and y = mx + c)		
PRACT-A	**PHYSICAL AND ANALYTICAL CHEMISTRY**	**1 credit (45 lects)**	**50**
PRACT-B	**INORGANIC AND ANALYTICAL CHEMISTRY**	**1 credit (45 lects)**	**50**
PRACT C	**ORGANIC AND ANALYTICAL CHEMISTRY**	**1 credit (45 lects)**	**50**

- **45 Lectures equivalent to 33.75 hours**
- **One Credit =16.87 hours equivalent to 17 Hours**
- **Curriculum Topics along with Self-Learning topics - to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT**

Self-Learning topics US-SCH-401

Topic	Online resource
Radioactive disintegration Sulphur system congruent melting point	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjA46GjhcDxAhUCSX0KHZWXD_4QFnoECDIQAA&url=https%3A%2F%2Fwww.epa.gov%2Fradiation%2Fradioactive-decay&usg=AOvVaw3cMA275kxOZr9O0j0ESDjH https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiFsaq7hcDxAhVaWX0KHbnmAhMQFnoECDYQAA&url=https%3A%2F%2Fchem.libretexts.org%2FBookshelves%2FGeneral_Chemistry%2FBook%253A_Chem1_(Lower)%2F07%253A_Solids_and_Liquids%2F7.05%253A_Changes_of_State&usg=AOvVaw1abjp4DGoqiojCjJRxqvPL https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjWrujOhcDxAhVTSX0KHVeZBtAQFnoECC8QAA&url=http%3A%2F%2Fweb.mst.edu%2F~ownby%2Fphase%2Fmelting.ppt&usg=AOvVaw2XKly2flrUAmKs6TZLptgw
Qualitative test for coordination compounds	https://youtu.be/VWX8vLfiuxg
Reduction of carboxylate acids by using different reducing agents	https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Map%3A_Organic_Chemistry_(Smith)/Chapter_20%3A_Introduction_to_Carbonyl_Chemistry_Organometallic_Reagents_Oxidation_and_Reduction/20.07_Reduction_of_Carboxylic_Acids_and_Their_Derivatives

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Self-Learning topics US-SCH-402

Topic	Online resource
Introduction to Laws Crystallography and Structure of NaCl and KCl.	https://edurev.in/studytube/Laws-Of-Crystallography-Solid-State--Physical-Chem/3180ffa6-f6cb-4ede-8cef-915d93dabfcf_t
Mechanism and Kinetics off Base Catalyzed Reactions and effect of pH on it.	https://www.sciencedirect.com/topics/chemistry/acid-base-catalysis
Physical properties and uses of concentrated oxo-acids -- sulfuric, Nitric and Phosphoric acid	https://youtu.be/G6eqa9C0djo
Nomenclature of heterocyclic compounds and methods of preparation of Furan, Thiophene, Pyrrole and Pyridine	https://nptel.ac.in/courses/104/105/104105034/

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Self-Learning topics US-SCH-403

Topic	Online resource
1.2.6: Solid phase extraction: principle process sand applications. 1.2.7 Comparison of solid phase extraction and solvent extraction	https://www.google.com/url?sa=t&rct=j&q=&esrc=s &source=web&cd=&cad=rja&uact=8&ved=2ahUKEwj0gN-aq7fxAhW84nMBHV2oBBoQFjAMegQIFxAD&url=https%3A%2F%2Fwww.sciencedirect.com%2Ftopics%2Fchemistry%2Fsolid-phase-extraction&usg=AOvVaw2v_xke0myETq5X7 AOH4AR1. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwidxvnDq7fxAhWp4XMBHZs4A6UQFjAREgQIExAD&url=https%3A%2F%2Fchem.libretexts.org%2FBookshelves%2FAnalytical_Chemistry%2FSupplemental_Modules_(Analytical_Chemistry)%2FAnalytical_Sciences_Digital_Library%2FActive_Learning%2FContextual_Modules%2FSample_Preparation%2F03_SolidPhase_Extraction&usg=AOvVaw2CEBlKbIJtB9xZwL9cHf-9
2.3.3 Types of conductometric titrations and titration curve. 2.3.4 Advantages and limitations of conductometric titrations	https://www.google.com/url?sa=t&rct=j&q=&esrc=s& source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjxgdi 7rbfxAhUL4XMBHagKCo8QFjAREgQIFxAD&url=https% 3A%2F%2Fwww.sciencedirect.com%2Ftopics%2F chemistry %2Fconductometric-titration&usg=AOvVaw3scg E0lDHah XQP7GFSWuu6 https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjxgdi7rbfxAhUL4XMBHagKCo8QtwIwEnoECBIQAw&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3Dfv7ozqXF-5Q&usg=AOvVaw1egB3NQ2Uo8yVXUaqOqnEF
3.1.4 Applications of gravimetric analysis	https://www.google.com/url?sa=t&rct=j&q=&esrc=s& source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiQhL2XtLfxAhUo8HMBHf1HDoAQFjAREgQIHRAD&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FGravimetric_analysis&usg=AOvVaw2vWRQFdmny-_1TmxPULU4o https://www.google.com/url?sa=t&rct=j&q=&esrc=s& source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiQhL2XtLfxAhUo8HMBHf1HDoAQFjAQegQIDRAD&url=http%3A%2F%2Fwww.ecs.umass.edu%2Fcee%2Freckhow%2Fcourses2F572%2F572bk15%2F572BK15.html&usg=AOvVaw04zVaq3JNF14JR-N29bJZC

PRACTICALS (3credits)	
Practical A	
Physical and Analytical Chemistry	Instrumental 1. To determine standard EMF and standard free energy of Daniel Cell 2. To determine the amount of HCl in the given sample by potentiometric titration 3. To determine dissociation constant of succinic acid conductometrically 4. Determination of % purity of vinegar using pH metry 5. Estimation of Fe Using 1,10 Phenanthroline colorimetrically Non Instrumental 1. To determine Energy of Activation /Compare the strength of HCl and H_2SO_4 by studying kinetics of acid hydrolysis of methyl acetate
Practical B	
Inorganic Chemistry Analytical Chemistry	1. Preparation of tris(thiourea) cuprous sulphate. 2. Synthesis of (complex)Tetrammine Copper (II) Sulphate hydrate[Cu(NH3)4]SO4.H2O **Qualitative inorganic analysis (minimum 4 mixtures to be done)** • Analysis of mixture salt containing two anions and two cations (From two different groups) from the following: • Anions: Carbonate, sulphate, chloride,, nitrate, phosphate. • Cations: iron, aluminum, manganese, calcium, strontium, barium, potassium and ammonium, magnesium.
Practical C	
Organic and Analytical Chemistry	**Preparation of:** 1. Glucosazone from dextrose or fructose. 2. m-Dinitrobenzene from nitrobenzene. 3. Acetanilide from aniline. 4. p-Bromoacetanilide from acetanilide. 5. Aspirin from salicylic acid. 6. Benzanilide from aniline. **Estimations** 1. Acetone 2. Aspirin

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Syllabus framing Committee

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1.	Dr Vijay Dabholkar	Professor	9930658855
2.	Dr. Sheela Valecha	Associate Prof	9820629865
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4.	Dr. Satish Kolte	Associate Prof	9821086024
5.	Mr. Karun Sodah	Assistant Prof	7302432297
6.	Dr. Rajesh Samant	Associate Prof	9869484326
7.	Dr. Yogita Shinde	Associate Prof	8828164779
8.	Dr. Charulata Chaturvedi	Assistant Prof	7738001960
9.	Ms.Mridula Gupta	Assistant Prof	9930002117

Advisory Committee

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Industry partner			
1.	Dr. Gulzar Waghoo	General Manager - Nerolac Paints	9819295421
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1	Dr. Kiran Mangaonkar	Principal - Guru Nanak Khalsa College, Mumbai	9833835824
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