



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** –Professor, Department of Chemistry,
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 - b. **Dr Sheela Valecha**- Associate Professor, Department of Chemistry,
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- 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,
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 - g. **Mrs Mridula Gupta**, Assistant Professor, Department of Chemistry, K. C. College,
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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 ,Dept 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 Koparkhairne, 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 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 30% marks (i.e. 12 out of 30) in the Internal Assessment and 70% marks in Semester End Examination (i.e. 24 Out of 60) separately, to pass the course and minimum of Grade E 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

learner who fails in not more than two courses of Semester I and Semester II taken together.

c. 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.

d. 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

learner shall pass Semester I and Semester II and fails in not more than two courses of Semester III and Semester IV taken together.

e. 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.

f. 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.

g. 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 leave 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 learners 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 Principal or the Head of the Institute OR fails in some or all the subjects is eligible to appear for the additional examination.

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.

The additional Semester End Examination shall be of two and half hours 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 secure 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.** Centralised 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 Upto
Upto - 50	2
051 - 100	3
101 - 150	4
151 - 200	5
201 - 250	6
251 - 300	7
301 - 350	8
351 - 400	9
401 and 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, which ever 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/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.

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 that 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/learners 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 Graduate and Post Graduate Semester End Examination / External Theory Examination.
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 required for Grade 'A' and above First Class/ distinction shall be carried out on random sample basis.
5. 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.
6. Moderation work shall be carried out simultaneously with the central assessment of answer books at CAPs.
7. Where marks awarded by the moderator vary from those awarded by original examiner, the marks awarded by the moderator shall be taken as final.
8. 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 Centres of University Examinations to:
 - i. Ensure that the University Examinations are conducted as per norms laid down.
 - ii. Observe whether the Senior Supervisors and Block Supervisors are following scrupulously instructions for conduct of the University Examinations.
 - iii. Check the students who try to resort to malpractices at the time of University Examinations and report such case to the University.
2. 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.

3. 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.

4. 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.

5. 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.

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.

2. Due to fraud, malpractices etc.

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

(2020-2021)

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 2020-2021

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 21st century. A Chemistry-based degree gives excellent qualification for a wide career choice within science industry or commerce.

The F. Y. B. Sc Chemistry syllabus US-FCH is a Choice based credit system comprising of two 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.

F. Y. B. Sc CHEMISTRY SYLLABUS

Semester-I

Summary

Sr. No.	Choice Based Credit System		Subject Code	Remarks
1	Core Course Chemistry		US-FCH-101, US-FCH-102, US-FCH1P1,USFCH1P2	
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-FCH -101	Physical, Inorganic, Organic Chemistry	3	20% *	3	0	0	2	10	20	10	60	100
2	US-FCH -102	Physical, Inorganic, Organic Chemistry	3	20% *	3	0	0	2	10	20	10	60	100
3	US-FCH- 1P1	Physical And Inorganic Chemistry			0	0	6	1	-	-	-	-	50
4	US-FCH- 1P2	Inorganic And Organic Chemistry			0	0		1	-	-	-	-	50
Total Hours / Credit								6	Total Marks				300

I Year Semester – I Units – Topics – Teaching Hours

Course code	Title	Credits	Total Marks
Paper 1 US-FCH-101 Theory	PHYSICAL, INORGANIC, ORGANIC CHEMISTRY	2 credits (45 lectures)	100 (60+40)
Unit I	1.1 Chemical Thermodynamics 1.2 Chemical calculations	15 lectures	
Unit II	2.1 Atomic structure 2.2 Periodic Table and periodicity	15 lectures	
Unit III	3.1 Classification and Nomenclature of Organic Compounds 3.2 Bonding and Structure of organic compounds 3.3 Fundamentals of organic reaction	15 lectures	
Paper 2 US-FCH-102 Theory	PHYSICAL, INORGANIC, ORGANIC CHEMISTRY	2 credits (45 lectures)	100 (60+40)
Unit I	1.1 Chemical Kinetics 1.2 Liquid state	15 lectures	
Unit II	Comparative Chemistry of Main Group Elements	15 lectures	
Unit III	Stereochemistry I	15 lectures	
	1.1 Chemical Kinetics 1.2 Liquid state		
PRACTICALS US-FCH- 1P1	PHYSICAL AND INORGANIC CHEMISTRY	1 credit (45 lectures)	50
PRACTICALS US-FCH- 1P2	INORGANIC AND ORGANIC CHEMISTRY	1 credit (45 lectures)	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

Paper 1 US-FCH-101
Theory(2 credits)

Unit 1 Physical Chemistry

(15hrs)

1.1 Chemical Thermodynamics

Thermodynamic terms: System, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state functions and path functions, zeroth law of thermodynamics

First law of thermodynamics: concept of heat (q), work (w), internal energy (U), statement of first law, enthalpy, relation between heat capacities, sign conventions, calculations of heat (q), work (w), internal energy (U), and enthalpy (H) (Numericals expected)

Thermochemistry: Heats of reactions, standard states, enthalpy of formation of molecules, enthalpy of combustion and its applications, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equation (Numericals expected)

1.2 Chemical Calculations

Expressing concentration of solutions: Normality, molality, molarity, formality, mole fractions, weight ratio, volume ratio, weight to volume ratio, ppm, ppb, millimoles, milliequivalents

(Numericals expected)

Unit 2 Inorganic Chemistry

(15 Hrs)

2.1 Atomic structure

Historical perspectives of the atomic structure; Rutherford's Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom.

Hydrogenic atoms:

1. Simple principles of quantum mechanics;
2. Atomic orbitals
 - i) Hydrogenic energy levels
 - ii) Shells, subshells and orbitals
 - iii) Electron spin
 - iv) Angular shapes of orbitals.
3. Many Electron Atoms
 - i) Penetration and shielding
 - ii) Effective nuclear charge
4. Aufbauprinciple

5. Hund's rule

2.2 Periodic Table and periodicity

- History of Periodic table,
- features of periodic table,
- position of hydrogen atom in the periodic table,
- Long form of Periodic Table;
- Classification for elements as main group, transition and inner transition elements;
- Periodicity in the following properties: Atomic and ionic size; electron gain enthalpy; ionization enthalpy, effective nuclear charge (Slater's rule); electronegativity (Pauling, Mulliken and Alfred Rochow electronegativities).

(Numerical problems expected wherever applicable)

Unit 3 Organic Chemistry (15 hrs)

3.1 Classification and Nomenclature of Organic Compounds

Review of the basic rules of IUPAC nomenclature. Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds:

alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines; including their cyclic analogues.

3.2 Bonding and Structure of organic compounds

Hybridization: sp^3 , sp^2 - sp hybridization of carbon and nitrogen; sp^3 and sp^2 hybridizations of oxygen in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide, amine and amide)

.Shapes of molecules; Influence of hybridization on bond properties (as applicable to ethane, ethene, ethyne)

3.3 Fundamentals of organic reaction mechanism

Electronic Effects: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strengths.

Bond fission: Electrophiles and Nucleophiles; Ambident Nucleophiles Nucleophilicity and basicity;

Types (primary, secondary, tertiary, allyl, benzyl), shape and their relative stability of reactive intermediates: Carbocations, Carbanions and Free radicals.

Introduction to types of organic reactions: Addition, Elimination, Substitution and Rearrangement reaction.

(With one example of each)

Self-Learning topics US-FCH-101

Topic	Online resource
Chemical Thermodynamics	https://nptel.ac.in/courses/104/106/104106089/
Thermochemistry	https://swayam.gov.in/nd1_noc20_cy09/preview
Atomic structure	https://nptel.ac.in/courses/104/101/104101090/ https://nptel.ac.in/courses/104/106/104106096/
Classification and Nomenclature of Organic Compounds	https://nptel.ac.in/courses/104/106/104106119/
Review of basic rules of IUPAC nomenclature	https://swayam.gov.in/nd2_nce19_sc16/preview

US- FCH-102

Theory (2 credits)

Unit 1 Physical Chemistry

(15 hrs)

1.1 Chemical Kinetics

Rate of reaction, rate constant, measurement of reaction rates, order and molecularity of reaction, integrated rate equation of first and second order reactions (with equal initial concentration of reactants) (Numericals expected)

Determination of order of reaction by (a) Integration method (b) Graphical method (c) Ostwald's isolation method (d) Half time method (Numericals expected)

1.2 Liquid State

Surface tension: Introduction, methods of determination of surface tension by drop number method (Numericals expected)

Viscosity: Introduction, coefficient of viscosity, relative viscosity, specific viscosity, reduced viscosity, determination of viscosity by Ostwald viscometer (Numericals expected)

Refractive index: Introduction, molar refraction and polarizability, determination of refractive index by Abbe's refractometer (Numericals expected)

Liquid crystals: Introduction, classification and structure of thermotropic phases (Nematic, smectic and cholesteric phases), applications of liquid crystals

Unit 2 Inorganic Chemistry

(15hrs)

2.1 Comparative chemistry of Main Group Elements

Comparative study of s block elements

Metallic and non-metallic nature, oxidation states, electro-negativity, anomalous behaviour of second period elements, allotropy, catenation, diagonal relationship. Comparative chemistry of carbides, nitrides, oxides and hydroxides of group I and group II elements.

Some Important compounds of s block elements(5)

Preparation and applications NaHCO_3 , Na_2CO_3 , NaCl , NaOH , CaO , CaCO_3

Unit 3 Organic Chemistry

Stereochemistry of Organic Compounds

Concept of Isomerism- All type of Isomerism (structural and stereo isomerism both)

Fischer Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3 dichlorobutane) and their interconversions;

Geometrical isomerism in alkene and cycloalkanes: cis–trans and syn-anti isomerism E/Z notations with C.I.P rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Distereoisomers, meso structures, racemic mixture and resolution(methodsof resolution not expected). Relative and absolute configuration: D/L and R/S designations.

Self-Learning topics US-FCH-102

Topic	Online resource
Chemical Kinetics	https://nptel.ac.in/courses/104/106/104106089/
Classifications of Liquid Crystals	https://swayam.gov.in/nd1_noc20_cy03/preview
Comparative study of s block elements	https://nptel.ac.in/courses/104/101/104101090/
Some Important compounds of s block elements: Preparation and applications NaHCO ₃ , Na ₂ CO ₃ , NaCl and NaOH	https://swayam.gov.in/nd2_nce19_sc16/preview
Chemistry of alkanes & Reactions of alkenes	alkynes https://nptel.ac.in/courses/104/106/104106119/

PRACTICALS (2 credits)			
Paper 1 US-FCH-1P1		1 credit	Ref books
Physical Chemistry	1. To determine the viscosity of given organic compound by Ostwald 's viscometer 2. To determine the rate constant for the acid hydrolysis of ester (methyl acetate) 3. To determine enthalpy of dissolution of salt (like KNO_3)	3 lectures per exp per batch	Ref books 24-27
Inorganic Chemistry	1. Gravimetric analysis a) To determine the percent purity of sample of BaSO_4 containing NH_4Cl b) To determine the percent purity of ZnO containing ZnCO_3 .		Ref book 28
Paper -2 US-FCH-1P2		1 credit	
Inorganic Chemistry	1. Analysis of commercial sample using standardized NaOH solution. a) HCl b) CH_3COOH 2. Titration using double indicator: analysis of solution of Na_2CO_3 and NaHCO_3 .	3 lectures per exp per batch	Ref book 28
Organic Chemistry	Characterisation of organic compound Compounds with C, H, (O) and / or C,H,(O),N / S / X.		Ref books 29-32

Note:

During the examination If in paper I Inorganic experiment is given then for paper II organic experiment is recommended. In case if paper I experiment is physical chemistry experiment then in paper II inorganic experiment is to be given. No student should get both inorganic experiment in paper I and Paper II

**I Year Semester – II
Summary**

Detail Scheme

SN.	Subject Code	Subject Title	Periods Per Week					Cr edit	Seasonal Evaluation Scheme				Tot al Marks
			Units	SL	L	T	P		S. L. E	CT	TA	SEE	
1	US-FCH -201	Physical, Inorganic, Organic Chemistry	3	20% *	3	0	0	2	10	20	10	60	100
2	US-FCH -202	Physical, Inorganic, Organic Chemistry	3	20% *	3	0	0	2	10	20	10	60	100
3	US-FCH- 2P1	Physical And Inorganic Chemistry			0	0	6	1	-	-	-	-	50
4	US-FCH- 2P2	Inorganic And Organic Chemistry			0	0		1	-	-	-	-	50
Total Hours / Credit								6	Total Marks				300

***One to two lectures to be taken for CONTINUOUS self -learning Evaluation.**

First year Semester -II Internal And External Assessment

Course code	Title	Credits	Total Marks
Paper 1 US-FCH-201 Theory	PHYSICAL, INORGANIC, ORGANIC CHEMISTRY	2 credits (45 lectures)	100 (60+40)
Unit I	1.1 Gaseous state 1.2 Chemical Equilibrium and thermodynamic parameters	15 lectures	
Unit II	2.1 Concept of Qualitative Analysis 2.2 Acid Base Theories	15 lectures	
Unit III	Chemistry of Aliphatic Hydrocarbons	15 lectures	
Paper 2 US-FCH-202 Theory	PHYSICAL, INORGANIC, ORGANIC CHEMISTRY	2 credits (45 lectures)	100 (60+40)
Unit I	1.1 Ionic equilibria 1.2 Photochemistry 1.3 Solid State Chemistry	15 lectures	
Unit II	2.1 Chemical bond and Reactivity 2.2 Introduction to co-ordination Chemistry	15 lectures	
Unit III	3.1 Stereochemistry II: Cycloalkanes and Conformational Analysis 3.2 Aromatic hydrocarbons	15 lectures	
PRACTICALS US-FCH- 2P1	PHYSICAL AND INORGANIC CHEMISTRY	1 credit (45 lectures)	50
PRACTICALS US-FCH- 2P2	INORGANIC AND ORGANIC CHEMISTRY	1 credit (45 lectures)	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

Unit-1: Physical Chemistry

[15 Hrs.]

1. 1 Gaseous State

Ideal gas laws, kinetic theory of gases, Maxwell-Boltzmann's distribution of velocities (qualitative discussion), ideal gases, real gases, compressibility factor, Boyle's temperature (Numericals expected).

Deviation from ideal gas laws, reasons for deviation from ideal gas laws, Van der Waals equation of state

1.2 Thermodynamic Parameters and Chemical Equilibria:

Statement of second law of thermodynamics, concepts of entropy and free energy, spontaneity and physical significance of free energy, Carnot's Cycle with derivation thermodynamic derivation of equilibrium constant (Numericals expected)

Reversible and irreversible reactions, law of mass action, dynamic equilibria, equilibrium constant, (K_c and K_p), relationship between K_c and K_p , Le Chatelier's principle, factors affecting chemical equilibrium (Numericals expected)

Unit-2: Inorganic Chemistry

[15 Hrs.]

2.1 Concept of Qualitative Analysis:

Testing of Gaseous Evolutes, Role of test Papers impregnated with Reagents in qualitative analysis (with reference to papers impregnated with starch iodide, potassium dichromate, lead acetate, dimethylglyoxime and oxine reagents).

a) Precipitation equilibria (with respect to saturation), solubility product, effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations and numerical problems expected.)

2.2 Acid Base Theories:

a) Acid base concepts: Arrhenius, Lowry- Bronsted(solid acids and bases), Lewis, Solvent-solute concepts of acid and base, HSAB concept. Applications of HSAB

b) Concept of neutralization titration using pH-metry, Volumetric analysis with special reference to calculation of titration curve involving strong acid and strong base.

Chemistry of Aliphatic Hydrocarbons**3.1 Carbon-Carbon sigma bonds:**

Chemistry of alkanes: Formation of alkanes, Kolbe's Reaction, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

3.2 Carbon-Carbon pi bonds:

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

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), Addition of Sulphuric Acid to Alkenes Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2- and 1, 4-addition reactions in conjugated dienes and, Diels-Alder reaction; Reduction of Alkenes

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

Self-Learning topics US- FCH-201

Topic	Online resource
Gaseous State	https://nptel.ac.in/courses/104/106/104106089/
Thermodynamic Parameters and Chemical Equilibria	https://nptel.ac.in/courses/104/106/104106094/ https://nptel.ac.in/courses/104/105/104105084/ https://nptel.ac.in/courses/104/106/104106107/ https://nptel.ac.in/courses/104/106/104106089/
Concept of neutralization titration	https://www.khanacademy.org/science/chemistry/acid-base-titration
Coordination Chemistry Part I	https://nptel.ac.in/courses/104/101/104101121/
Reaction of alkenes- Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition) with sulphuric acid example.	https://swayam.gov.in/nd2_cec20_ma07/preview

Unit1:Physical Chemistry

[15 Hrs.]

1.1 Ionic Equilibria

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water, ionization of weak acids and bases

1.2 Photochemistry

Principle, Laws of photochemistry, quantum yield and its determination, Primary and secondary reaction, reasons for high and low quantum yield, study of photochemical reactions (i) reaction of hydrogen and chlorine (ii) dissociation of hydrogen iodide. Photosensitizer and photosensitized reactions, photochemical smog, ozone depletion, concept of flash photolysis

1.3 Solid State Chemistry

Types of solids, crystal lattice, lattice points, unit cell, space lattice and lattice plane, laws of crystallography: Law of constancy of interfacial angle, law of symmetry and law of rational indices (Numericals expected)

Unit - 2:Inorganic Chemistry

[15 Hrs.]

2.1 Chemical Bond and Reactivity

Types of chemical bond, comparison between ionic and covalent bonds, polarizability

(Fajan's Rule), shapes of molecules, Lewis dot structure, Sidgwick Powell Theory, basic VSEPR theory for AB_n type molecules with and without lone pair of electrons, isoelectronic principles, applications and limitations of VSEPR theory.

2.2 Coordination Chemistry Part I

Valence Bond Theory- Introduction, postulates , examples and limitations.

Molecular Orbital theory- Introduction.

Unit-3: Organic Chemistry

[15 Hrs.]

3.1Stereochemistry-II: Cycloalkanes And Conformational Analysis

Conformation analysis of alkanes (ethane, propane and n-butane); Relative stability with energy diagrams.

Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy.

3.4 Aromatic Hydrocarbons

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

Self-Learning topics US- FCH-202

Topic	Online resource
Photochemistry	https://nptel.ac.in/courses/104/106/104106077/
Solid State Chemistry	https://nptel.ac.in/courses/104/104/104104101/
Coordination Chemistry	https://nptel.ac.in/courses/104/101/104101090/ https://nptel.ac.in/courses/104/105/104105033/
Stereochemistry-II: Cycloalkanes and Conformational Analysis	https://nptel.ac.in/courses/104/105/104105086/
Aromatic Hydrocarbons	https://nptel.ac.in/courses/104/103/104103110/
Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft alkylation/acylation with their mechanism	https://swayam.gov.in/nd2_cec20_ma07/preview

PRACTICALS (2 credits)

US-FCH-2P1 Paper I		1 credit	Ref books
Physical Chemistry	<ol style="list-style-type: none"> To determine the rate constant for the saponification reaction between ethyl acetate and NaOH. To prepare various compositions of buffer solutions of different pH using sodium acetate and acetic acid solutions and determine their pH values by using pH meter. To determine concentration of given sample of KMnO_4 by colorimetric method(Learners are expected to determine λ_{max}) and plot calibration curve. Oxidation reduction titration : Oxalic acid and KMnO_4 	3 lectures per exp per batch	Ref books 2-27

<p>Inorganic Chemistry</p>	<p>Qualitative analysis: (at least 4 mixtures to be analyzed)</p> <p>Semi-micro inorganic qualitative analysis of a sample containing two cations and two anions.</p> <p>Cations (from amongst): Pb²⁺, Ba²⁺, Ca²⁺, Sr²⁺, Cu²⁺, Cd²⁺, Fe²⁺, Ni²⁺, Mn²⁺, Mg²⁺, Al³⁺, Cr³⁺, K⁺, NH⁴⁺</p> <p>Anions (From amongst): CO₃²⁻, S²⁻, SO₃²⁻, NO₂⁻, NO₃⁻, Cl⁻, Br⁻, I⁻, SO₄²⁻, PO₄³⁻</p> <p>(Scheme of analysis should avoid use of sulphide ion in any form for precipitation / separation of cations).</p>		<p>Ref book 28</p>
<p>US-FCH-2P2 Paper -2</p>		<p>Credit</p>	
<p>Inorganic Chemistry</p>	<p>Redox Titration:</p> <p>To determine the percentage of copper(II) present in a given sample by titration against a standard aqueous solution of sodium thiosulfate (iodometry titration)</p>		<p>Ref book 28</p>
<p>Organic Chemistry</p>	<p>1. Purification of any two organic compounds by recrystallization selecting suitable solvent.(Provide 1g.). Learners are expected to report a) Solvent for recrystallization. b) Mass and the melting points of purified compound.</p> <p>2. Chromatography (Any one) a) Separation of a mixture of two sugars by ascending paper chromatography</p> <p>3. Separation of a mixture of o-and p-nitrophenols by thin layer chromatography (TLC)</p>	<p>3 lectures per exp per batch</p>	<p>Ref books 29- 32</p>

Note:

During the examination If in paper I Inorganic experiment is given then for paper II organic experiment is recommended. In case if paper I experiment is physical chemistry experiment then in paper II inorganic experiment is to be given. No student should get both inorganic experiment in paper I and Paper II

Reference Books:-

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).
3. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
4. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
5. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013).
6. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press (2014).
7. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd.,New Delhi (2004).
8. Levine I.N., Physical Chemistry, 6th Ed., Tata McGraw Hill (2010).
9. Metz C.R., 2000 Solved Problems in Chemistry, Schaum Series (2006).
10. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
11. Banwell C.N., Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill (1994).
12. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).
13. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
14. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
15. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
16. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962
17. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.
18. Morrison, R.T. and Boyd, R.N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd.
19. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
20. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
21. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
22. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
23. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

Reference Books for Practical:

Physical Chemistry:

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