ACADEMICS & CAREER COUNCIL

CHEMISTRY

Department Guide

Table of Contents

Introduction

The Department of Chemistry at the Indian Institute of Technology Kanpur is renowned for its excellence in teaching and research in India. Established in the early 1960s under the leadership of Professor C.N.R. Rao, the department has consistently advanced and established itself as a leader in modern chemistry education and research. The department comprises 39 faculty members, 119 undergraduate students, 93 master's students, 276 doctoral students, 31 post-doctoral researchers, and 35 staff members. Over the years, it has steadily grown, enhancing its academic visibility and becoming a leader in chemical sciences research in India.

Mission and Vision

- To provide premier teaching and research in modern chemistry, fostering a challenging educational environment.
- Advance the frontiers of chemical knowledge through cutting-edge research.
- To continuously grow in visibility and leadership in chemical sciences' academic and research landscapes.
- Contribute to solving global challenges with innovative scientific solutions.

Key People To Contact:

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DUGC Convener
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CHM Dept. Brochure QR Code:

Template for BS Chemistry:

Template for 3rd to 8th semester for BS program in Chemistry					
Semester 3	**Semester 4**	**Semester 5**	**Semester 6**	**Semester 7**	**Semester 8**
SCHEME-2 EME (9-11)	SCHEME-3 HSS-I (9-11)	CHM303 (9)	SCHEME* HSS-II (9)	SCHEME* HSS-II (9)	SCHEME* HSS-II (9)
CHM201 (9)	ESC201 (14)	CHM305 (6)	CHM322 (9)	DE-2 (9)	UGP-4 (9) (CHM492)/DE-4 (9)
CHM221 (9)	CHM202 (9)	CHM321 (9)	CHM342 (9)	UGP-3 (9) (CHM491)/DE-3 (9)	OE-3 (9)
CHM241 (9)	CHM222 (9)	CHM345 (9)	CHM344 (6)	OE-1 (9)	OE-4 (9)
E/SO (≥ 9) Or Two E/SO (≥ 6)*	CHM242 (9)	CHM361 (6)	CHM402 (9)	OE-2 (9)	OE-5 (9)
		UGP-1 (4) (CHM391)	CHM324 (6)		OE-6 (9)
		E/SO (≥ 9)	UGP-2 (9) (CHM392)/DE-1 (9)		
45-50	50-52	52	57	45	54

WALKTHROUGH

THE FRESHMAN YEAR

Welcome to IIT Kanpur! The first year at the institute is a memorable experience. Some dive into academics, aiming for a change in their branch, while many explore the campus, making friends and engaging in various extracurricular activities, including sports, cultural events, and technical pursuits. Inter-Hall competitions are an integral part of freshman extracurriculars and create lifelong memories.

Let us guide you through what your undergraduate journey in the department will look like.

Your IC courses cover subjects like:

- **Mathematics (MTH111, MTH112, MTH113, and MTH114),**
- **Physics (PHY112 and PHY113),**
- **Computing (ESC111 and ESC112),**
- **Technical Arts (TA111),**
- **Chemistry (CHM111, CHM112 and CHM113),**
- **Biology (LIF111 and LIF112),**
- **Physical Exercise (PE).**

Additionally, you'll have your HSS Level-1 course, like English (ELC111/2/3) and Ethics (ETH111).

These experiences pave the way for a fulfilling and enriching undergraduate journey at IIT Kanpur.
Your freshman CPI will also be considered for branch change for those interested.

TA111 (Engineering Graphics)

It is a 9 credits course which introduces student to Engineering Drawing. Completing assignments independently and fully grasping the concepts can be extremely beneficial.

ESC111M and ESC112M (Fundamentals of Computing)

It comprises ESC111M and ESC112M, each caries 7 credits. It introduces students to programming in C language. Prior coding knowledge helps a lot; however, a complete beginner can also score top grades by understanding concepts in regular practice.

MTH 111M, MTH 112M, MTH 113M, MTH 114M

These are a series of modular courses taking place in the freshmen year. MTH111M explains real numbers and covers limits, continuity, differentiability, derivatives, and other calculus theorems. MTH112M also includes testing the application of these concepts. MTH113M is Linear Algebra, and MTH114M is Ordinary Differential Equations. Students find it hard to write subjective answers and satisfactory proofs. Solving tutorial assignments regularly is the key. Doing PYQs will help a lot. Also, do not hesitate to take the help of AMs!

PHY 112 and PHY 113

PHY112 (Classical Dynamics) has topics like Newton's laws, rigid body dynamics, and Lagrangian. Book recommended: Morin. Meanwhile, PHY113 (Classical Electrodynamics) covers topics related to electromagnetism. Book recommend: Griffiths.
Both of these courses are 11-credit courses that will give you a basic understanding of the physics domain and will be taught in SEM 1 and SEM 2, respectively.

OTHER COURSES

LIF111, CHM111, CHM112, CHM113, PHY111 are quite easy. Studying regularly and doing assignments will help. PE101 and PE102 are fun and doable. Students fail these courses because of the attendance policy, so take care of that and you will be fine.

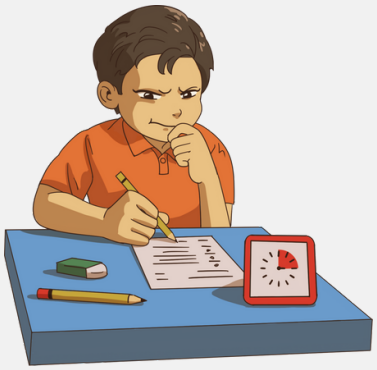
BRANCH CHANGE

The DoAA office will call for branch change applications twice an academic year in April and November.
A BT/BS student may choose to apply for a change to a BT/BS program in any other discipline, including a Multidisciplinary programme (BT) in Engineering Sciences, which is offered in two streams:

(i) Engineering Science (Mechanics)
(ii)Engineering Science (Energy, Environment and Climate).

Once a branch change has been granted, students are expected to follow the template for the new department to which they have been admitted.

Eligibility Criteria:



- A student may apply after her/his second semester if she/he have acquired credits (i.e., received a passing grade) for all the courses prescribed in the template for the first year.
- Any student may apply after their third or fourth semester even if they have NOT acquired credits (i.e., received a passing grade) for all the courses prescribed in the template for the first year.

NOTE:

- Once a Branch Change has been granted, a student cannot revert to the original department.
- For eligibility the courses for which S/X grade is awarded are also considered.

THE SOPHOMORE YEAR

Your 2nd year will introduce you to your department's core courses. And the CHM dept is pretty chill, at least in 2nd year . It is because there are no labs. The courses are doable. Every semester, we have physical, organic and inorganic chemistry. Organic and Inorganic are a little tricky yet exciting if you persistently keep an eye on them you will surely ace them. .

Some of the courses are:

- **CHM201:**

It is a 9-credit course. This course introduces organic molecules and functional groups, understanding organic reactions, catalysis, and stereochemistry in organic synthesis.

- **ESC201:**

This 11-credit course is designed to facilitate understanding introductory concepts in electronics. Accordingly, the course objectives include an introduction to electronics, analysis, designing electronic circuits and gaining hands-on experience in building and analyzing electronic circuits in the laboratory.

- **CHM242:**

It is a 9-credit course. The fundamental aspects of inorganic chemistry and its applications will be taught in this course.

- **CHM202:**

The course CHM202A at IIT Kanpur is titled "Basic Organic Chemistry -II". It covers oxidation and reduction reactions, including various reagents and conditions.

THE JUNIOR YEAR

In the junior year, students become more focused. They begin to pursue their future interests through internships (industrial or academic) and projects with professors. Some students opt for a dual degree if their CPI isn't high enough. Those with a good CPI may pursue double majors in departments such as CSE, MTH, and SDS and Minors in fields like circuital branches.

In the third year, students face a few demanding courses, typically 2-3, which can vary based on the individual. You will spend about 90% of your time studying chemistry this year. If you develop an interest in chemistry, you might pursue it further. If not, you can still perform well to achieve a high CPI, which benefits obtaining minors in other departments and maintaining a strong academic record. This can be advantageous for placements, applying to foreign universities, and other opportunities.

Some of the courses are:

- **CHM303**

It is a 9-credit course. It covers stereochemistry, dynamic stereochemistry, chemo, regio and stereoselective reactions.

- **CHM402**

An advanced course of CHM202. It covers advanced topics in organic chemistry, including various oxidation and reduction reactions, organo-sulfur and organo-selenium compounds, and transition metal-catalyzed reactions.

- **CHM342**

It is a 6-credit course. It covers topics such as the estimation of iron by UV-vis spectrophotometry and principles of colourimetric analysis.

INTERNS

The first 2-3 months of the year are spent preparing for internships. The internship season began in August. Many students started their preparations in May, working on puzzles, practising coding, and other relevant skills. Students who secure internships then focus mainly on academics, while those who don't continue to seek off-campus internships.

For BS, some companies are not open to being applied for, but that doesn't restrict the opportunities. Deciding beforehand what is your target, like SDE, Data Science, Consulting, etc., helps one to prepare well beforehand.

Having a good CPI, preferably 7+ and, in the best case, 7.5+ (for consulting, 8+), will not create hindrance on the CPI side.
Good preparation and good CPI will be the only criteria for reaching an interview and, of course, clearing any screening test.

From our department only, people with good CPI and preparation got through the intern season well. But sometimes, BS restricts opportunities; that's where you need to look off-campus. After November, one should start applying off-campus through LinkedIn.

Apart from industry interns, there are ample opportunities in research internships abroad, there are various programs like MITACS, Charpak Scholarships etc. and many more by reaching out to professors or university programs which one should explore. Again a good CPI and timely application will help.

Undergraduate Projects (UGPs)

There are four UGPs in the template – three of 9 credits each and one with 4 credits. The 9-credit UGP is optional, and students trying to build a research profile do it. A 9-credit UGP can be swapped for a DE. Look for profs based on your research interests and approach them. UGPs will help if you want to go for a Master's in the future. You can get recommendations from these profs.

UGP offered are:

CHM391 and CHM491 in ODD semesters and CHM392 and CHM492 in EVEN semesters.

The only prerequisite for joining a project under a professor is enthusiasm. The steps are straightforward: Google the professor's interests; if the domain in which he/she works resonates with your interests, then go ahead and write a letter for a meeting and express your desire to work with him. Here, the game is win or learn. Either he will agree or tell you to read some material and return or refer you to someone else after some time.

NOTE:

A student can, at most, take one UGP per semester. However, students may apply for different projects under professors other than UGPs according to their research interests by approaching professors with the same research interests.

THE SENIOR YEAR

What a feeling it is to reach the Fourth Year after clearing a ton of academics. Your fourth and final year will not have any DC course (unless you have some backlog). It will only comprise (Department electives)DEs and (open electives)OEs. Students use these courses to explore other fields and/or get a minor in some other department. Students doing a Double Major use their OE slots to fulfil the requirements of the Double Major department. You can also pursue a more profound research project as a UGP (Undergraduate Project).

Final Year is also the time for placements. Students sit for the SPO placement process and target roles as per their interest, whether it be a Core Role, an IT role, or a management role. Students interested in further studies and research start their application process for MS or PhD admissions in other universities. Some students also pursue other interests, such as an MBA or preparation for other exams.

This piece is certainly not justice to the ever-thrilling life of an undergraduate student by summarizing everything in a few pages. Still, we have tried to be as close to the reality as possible.

Choosing DE/OE:

Give priority to courses needed for your minor if you have taken up any minor. If you haven't opted for a minor, go for OE/DEs that are easy to score in or involve topics that interest you. Also, it's easier to get OEs of your choice in the 8th semester, which is a good opportunity if you want to learn topics outside of economics.

DOUBLE MAJOR

This program gives a Bachelor's degree with majors in two departments. The first major is in the parent department and the second major is in the department to which the student applied. You can apply at the end of 4th and 7th semester.

TEMPLATE :

Odd semester courses	Even semester courses
CHM201 (9)	CHM202 (9)
CHM221 (9)	CHM222 (9)
CHM241 (9)	CHM242 (9)
CHM303 (9)	CHM324 (6)
CHM305 (6)	CHM342 (9)
CHM321 (9)	CHM344 (6)
51	48

More about the programme:

- Students having a minimum of 7.0 CPI can apply at the end of the 4th semester.
- Admission to the Double Major programme is subject to departmental CPI criteria, overall CPI ranking, and availability of seats.
- The normal duration for this program is 5 years (= 10 semesters), but it can be done in a maximum of 12 semesters from a minimum of 9 semesters.
- Students who opt for a Double Major are required to complete Departmental Compulsory Courses [DCs] and some Departmental Electives [DEs] in their second major discipline, in addition to completing all the requirements of their parent discipline. The Institute Core courses and the HSS electives will be done only once.

NOTE :

- Double major students will be advised by both the parent and host department DUGC conveners.
- OE course slots and overloads can be used to complete requirements. A maximum of 36 OE credits can be waived from parent department requirements. Students may further take relevant courses (if offered) for a maximum of 25 credits in the summer term.
- If a student opts for a Double Major in another department, then he/she will not be able to apply for a Dual Degree or minor in any other department, including his/her department.
- A student may withdraw from the Double Major programme anytime by submitting an application to the Chairperson SUGC.
- In such a case, all credits taken for the second major will be counted as OE credits in the parent department, and the student will graduate with a degree in the parent department only.

DUAL DEGREE

The dual degree is a good opportunity to know what research is like and decide if you want to pursue it in the future.
This is a five-year programme in which a student obtains a Master's degree in Chemistry along with a Bachelor's degree in the parent department. There are two categories in this programme.

- Category A: Both degrees are given by the Chemistry department.
- Category B: The Master's degree is given by the Chemistry department, while the Bachelor's degree is given by the parent department.

The dual degree programme requires students to complete all their Bachelor's programme requirements in addition to completing required post-graduate courses to gain a strong foundation in their chosen Master's discipline. These may include seminar courses in certain disciplines. In addition, the Master's part of the programme also requires a thesis or project in certain disciplines to provide students with research experience.
Students should have a minimum CPI of 6.0 at the time of applying.

TEMPLATE (CATEGORY A) :

Bachelors-Masters (five-year Dual-degree) program (Category A)			
UG Pre-requisites		PG Components	
Odd Semesters	Even Semesters	Semester 9	Semester 10
CHM503A (6)	CHM443 (6)	CHM611A (9)	MS Project (48)
CHM423 (6)		CHM621A (9)	
		CHM631A (9)	
		DE PG-1 (9)	
		DE PG-2 (9)	
		DE PG-3 (9)	
18	00	54	48

TEMPLATE (CATEGORY B) :

Bachelors-Masters (five-year Dual-degree) program (Category B).		
Mandatory UG Components	PG Components	
	Semester 9	Semester 10
CHM DE-1 (9)	MS Project-1 (24)	MS Project-2 (24)
CHM DE-2 (9)	CHM305 (6)	CHM344 (6)
CHM DE-3 (9)	CHM DE-6 (9)	CHM324 (6)
CHM DE-4 (9)	CHM DE-7 (9)	CHM DE-8 (9)
CHM DE-5 (9)		CHM DE-9 (9)
45	48	54

NOTE : Students opting for the Dual Degree programme will not be allowed to do a Double Major.

IS DUAL DEGREE FOR ME?

There are numerous advantages associated with choosing a dual degree program. Typically, students tend to consider pursuing a dual degree around the 7th semester once they have made a firm decision about it. The primary reasons why students opt for dual degrees include:

1. Interest in conducting research in the chemistry field is often sparked by different DCs/DEs taken during the second and third years, as well as involvement in projects under professors or clubs.
2. Desire to pursue a career in a core Chemistry field.
3. Additional time is required to prepare for the placement season.

MINORS

Students may include a specialization within a discipline other than their parent discipline during the regular 4-year Bachelor's programme. This specialization is called a Minor and is acknowledged as such on a student's grade sheet. A Minor can be completed within the time and credits required for a student's regular 4-year Bachelors' programme.

TEMPLATE :

Physical Chemistry	Inorganic Chemistry	Organic Chemistry
CHM221 (9)	CHM241 (9)	CHM201 (9)
CHM222 (9)	CHM242 (9)	CHM202 (9)
	CHM345 (9)	CHM303 (9)
Any two courses from the following: CHM321 (9) CHM322 (9) CHM621A (9) CHM622A (9) CHM626A (9) CHM636A (9) CHM637A (9) CHM650A (9) CHM664A (9) CHM685A (9) CHM689A (9) CHM695A (9) CHM696A (9) CHM697A (9)	Any one course from the following: CHM342 (9) CHM616A (9) CHM631A (9) CHM646A (9) CHM647A (9) CHM651A (9) CHM654A (9) CHM668A (9) CHM691A (9)	Any one course from the following: CHM402 (9) CHM481 (9) CHM602A (9) CHM611A (9) CHM612A (9) CHM662A (9)
36	36	36

- There is no CPI criterion for Minors. Admission is based only on the availability of seats.
- Students (except those in the Double Major programme) may apply for a Minor during their 4th, 5th, or 6th semester.
- A student can get more than one Minor.

PLACEMENTs

After a summer of internships and projects, placement preparation begins during the fourth year. July, August, and September are key months for this preparation. While placement tests start in September and are initially infrequent, they become more frequent over time. Because of the overlap with semester exams, it's best to start preparing early. Group study and discussions with friends can be very helpful.

Similar to interns, a good CPI (7+ or 7.5+) and good prep will take one through the placements. Again, some companies are not open to BS, but that isn't a lot to worry about.
Good projects add a lot of weight to the resume. If not from club/society projects, try to get projects under professors that'll add relevant experience to the resume.

Resume-making is also a very important point, so one should start it early so that by the deadline, they can refer seniors and check if their resumes are well-built or not.

For prep: DSA + interviewbit + lot of practice
puzzles + guesstimates for interview.

For different profiles, preparation is a little different. For data analysts, one should also know SQL, pandas, etc.

For Finance roles, generally, finance projects help to get to the interview.

Also, having a POR helps but does not guarantee you any placement solely based on POR.

PROGRAMME REVIEWS

- AAKRITI GUPTA, Y21

Q : How should a fresh student navigate his semesters right from the third Semester to make the best use of opportunities ahead?

A : If there's no plan, the one rigid aim should be to never allow your CPI to drop that'll affect your career from any perspective be it placements or research.

I know talent and knowledge matters, but generally this has to be accompanied with a good academic record.

Take courses very carefully, before every pre registration devote time to select ESOs, OEs, DEs and projects.

Always be assured your are in your credit limits

If you not sure how to check it, consult the department mentor or DUGC nominees. And don't take advice from only one senior talk to as many seniors you can from the department and outside the department too. Sometimes opportunities are not restricted to department.

Apart from studies, one should engage in Gymkhana activities as well as per the interest. It helps to give a holistic experience of the campus. But again everything should be within it's good limit.

In simple words the advice is that: NEVER compromise with your academics

Q : Advice on courses that need extra care and attention.

A: Quantum Mechanics (CHM322): One needs to be extremely regular with what's going on in the class and practice a lot to get a good grade.

Inorganic Chemistry (CHM321): It depends on prof as well, but group theory is a really important concept in inorganic chemistry so one should be really careful while learning that.

General Advice: Generally, courses are easy to get through if one is regular in classes and goes through the material provided well. Most of the time, students skip classes and delays catching up, making it difficult to get through a course

.

CHOOSING ESO/SO COURSES : If you have a decent CPI in the 1st year then you can choose courses that will help you build your resume or go for the courses you are interested in .If you do not have any specific interests or no resistance to particular ESOs ,you can go for the popular ones or the scoring ones with good grading .

If you have a low CPI and you want to improve your CPI ,go for easy courses or less competitive ones ,learn about the profs and find about grading trends. Students also have to select HSS courses in the upcoming semesters which they may choose a way to make CPI better .

We sincerely thank **AAKRITI GUPTA, Y21** for taking time out of their busy schedule to help us create this comprehensive guide with their valuable suggestions.

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