

# Guide to Branches

The ultimate guide to choosing a perfect branch

WatchOut!

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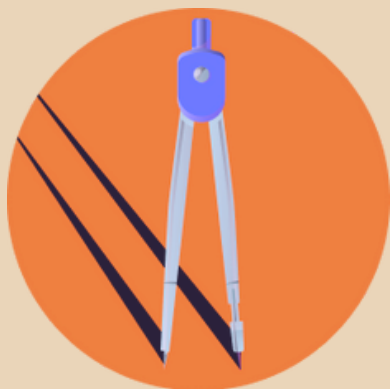
# The Ultimate Guide to choosing the perfect branch.

Created with the aim to help you take one of the most difficult decisions of your life, a very precise, factual and painstakingly devised guide to the branches offered to Undergraduate students joining IIT Roorkee

P.S. We've taken the liberty of adding our own tidbits and a few spoonfuls of on-ground reality apart from the academics of it all. Do consume with a pinch of salt !

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## Architecture

Buildings, mansions, forts, towers, castles, dreams, we make em all. IIT Roorkee offers the country's best course in B. Arch. Don't believe us? The architectural grandeur of the Thomason Building will surely convince you.

The funky, night owls carrying round barrels around their shoulders can be seen wandering at any given time around the prettiest department building in town, i.e. the Department of Architecture and Planning.

These creatures are victims, ahem, students of Architecture and are the most sought-after roommates courtesy of their assignments which ask them to redesign their room every semester.

## Courses and Syllabus

The study of architecture requires one to be a skilled generalist, a jack of all trades, who can combine knowledge from diverse fields and translate it into thoughtful spaces which speak to the people. The course is therefore designed to expose one to a vast variety of topics.

The constituent courses of the bachelor's degree (as ascribed by the Council of Architecture) are centred around "Architectural Design", which will be found in all semesters except 1-1, 4-2 and 5-2.

In addition to studying core architectural concepts, history, construction technologies and various allied subjects like interior and landscape design, some subjects from the civil, mechanical and electrical department are taught too. The course as a whole is rather challenging. It involves the longest contact hours of all courses and a great load of assignments (resulting in many late nights), which eventually decrease. Good grades call for a great deal of consistency in submissions.

## Features

Educational trips are also a crucial part of the curriculum and you can expect to go on some nice trips throughout the course. The department has numerous labs dedicated to different areas of research and house some of the most advanced equipment which can be used by the students.

The faculty of the department conduct high quality research in many fields ranging from embodied energy and accessibility to sustainability and computer applications in the field of architecture. Interested students can easily approach them and undertake research projects or work with them as research interns.

## Future Prospects, Internships and Placements

In core architecture, there are many fields to choose from, like urban planning, interior design, landscape design etc. and students may choose to specialize in these areas. A program called SURA (Summer Undergraduate Research Awards) is in place (which has a somewhat drawn-out application process). For architecture students, an additional opportunity lies in the form of the CBRI (Central Building Research Institute), which, although an autonomous body, abuts our campus and welcomes IITR students wishing to undertake research. In the 4th year, students have to go through a mandatory 6 months internship, and aside from this many also go for summer internships according to their choice.

The department also offers a student exchange program to HSLU, Switzerland for students in 4th year.

Other architectural colleges do not have placements, or any sort of arrangements wherein graduates can find firms to employ them. At IITR, students can find the best core placements possible, however they opt otherwise. Architecture graduates can get non-core jobs provided they are meritorious. Some companies may selectively not open to architecture students for interns and placements, but opportunities are still ample.



## Biosciences and Bioengineering

The department of Biosciences and Bioengineering is perhaps one of the cleanest places of IITR. That's primarily because it's got a relatively new building. An urban legend says that the previous building caught fire and was abandoned. There are many theories surrounding the cause of fire but most of them are absurd at best. A typical biotech undergrad usually plans their industrial trip for two whole years. They spend the next two years posting the 4200 photos they took while on the trip and reminiscing about the trip to anyone who'll listen.

## Courses and Syllabus

The subjects can be broadly classified into two types, research-based and engineering-based. The former consists of Genetic Engineering, Cell and Microbiology, Immunotechnology, Biochemistry and Biophysics, Microbial Technology, Animal and Plant Technology, IPR and Bioethics, Nano-biotechnology, Food Technology and Drug Design; while the latter includes Bioreactor design, Fluid Mechanics, Bio-separation techniques, Principles of Bioreaction Engineering, and Enzyme Technology. There are countless research fields in this department. Broadly these fields could be related to Cancer Research, Stem Cell Research, Infectious Diseases, Immunological Studies, Drug Design, Neuroscience, Evolutionary Biology, and Biomedical Engineering.

## Features

The most salient feature of the branch, apart from the glitzy kinda-new building and research labs as mentioned above, is the limited class strength as compared to the other branches.

This facilitates interaction amongst each other, and with the faculty members. Most of the coursework is focused on research-based areas in biological sciences.

There are paper presentation and poster presentation competitions and global conferences related to this discipline. Undergraduate students don't generally go for these unless they have been involved in some active research alongside their coursework and the lab heads (professors) encourage them to take part and even provide suitable support (finances, permissions etc.).

## Future Prospects, Internships and Placements

Although the job opportunities in the core sector are limited after B-Tech, the scope widens immensely after getting a specialization. You can choose between policymaking in regulatory bodies (UN, FDA, FAO), jobs as technical heads in the biotech/pharmaceutical industry, and engineers in biomedical instrumentation. Engineering-based internships are offered by pharmaceutical companies like Biocon, Cipla, Ranbaxy, and Biozeen.

Some popular internship programs in the global scenario are Mitacs-Globalink (Canada), DAAD-WISE (Germany), VISERA (Vanderbilt University, US), Khorana Scholarship, OIST (Okinawa Institute, Japan), Duke University (US) and University of Queensland (Australia). Apart from these, due to the ample flow of funds in biosciences, many professors accept international interns for a period of 2-3 months for summer/winter interns in their labs. TIFR, IISc, CMBL, CBRI, CDRI, etc. are some of the research facilities within India which provide excellent research opportunities. iGEM is a worldwide synthetic biology competition that undergrad students look forward to participating in.



## Chemical Engineering

The department of chemical engineering is by far the most notorious department at IITR. The building in itself looks like a remnant of older and simpler times.

Undergrads of this course like to refer to themselves as chemi-cools even though nobody else agrees with them.

## Courses and Syllabus

Chemical Engineering, although hinting at an obvious and close relevance to Chemistry by its very name, bears no relation to it other than sharing its basic concepts. A clearer answer to what Chemical Engineering is, lies at the end of a four-year-long journey.

Like in most branches, it turns out that the core subjects contribute a major chunk to the grades. Thus, a list of the important courses in Chemical Engineering go like this: Engineering Management, Chemical Reaction Engineering, Transport Phenomena, Chemical Engineering Thermodynamics, Chemical Process Principles, Chemical Engineering Equipment Design, Fluid Mechanics and Mechanical Operations. The last two on the list, though not counted as 'core' subjects, complete the curriculum and help in understanding the fundamentals in this field of engineering.

## Features

The workload, to a great deal, depends on an individual's deal with the clock. Speaking in terms of contact hours, a chemical engineer works about 26 hours a week. Generally, one lab-based course engages you every semester. Some of the many diverse areas open to research for a chemical engineer are Thermodynamics and Molecular Computations, Catalysis and Reaction Engineering, Systems Design, and Engineering, Transport Processes, Biological Engineering, Materials, Polymers, Surfaces and Structures, and Energy and Environmental Engineering.

## Future Prospects, Internships and Placements

The industrial heavyweights like ITC, Schlumberger, Shell, RB and Reliance offers the best internship and placement opportunities. The core followers find major employers in gas and oil extraction, oil refining, nuclear and power generation, and other process industries such as pharmaceuticals. A good number is absorbed by industries such as food & drinks, toiletries, pulp, and paper, polymer, and textile. Certain job profiles (apart from a Chemical Engineer, of course) that relate directly in this field are Energy Engineer, Petroleum Engineer, Product/Process Development Scientist, Analytical Chemist, Energy Manager, Manufacturing Engineer, Materials Engineer, Mining Engineer, Production Manager, and Quality Manager, among others.

The professors eagerly back students who are willing to take up innovative projects. Available options include taking up simple/fun projects or experiments, such as testing the efficiency of pumping and motor systems installed in the labs, or studying the performance of air conditioning or condenser systems in the department buildings.



## Civil Engineering

In the beginning when the Universe was created, nothing happened for a few billion years. Nothing besides the cataclysmic explosion resulting in a hot dense Fireball expanding light years into nothingness and ultimately condensing to form the stars, planets and Starbucks outlets. Sometime in between came the Thomason College of Civil Engineering. We believe nothing speaks as much for a department as it being the sole reason for its institute's conception.

## Courses and Syllabus

Civil engineering can be divided into various sub-disciplines like structural engineering, environmental engineering, transportation engineering, geotechnical engineering, water resources engineering, wastewater engineering, and construction surveying, etc. Over the course of four years, an equal emphasis is given to each of these sub-disciplines, and a basic introduction is offered to the less important ones. The timetable is slightly on the hectic side but with a tad bit of judgment, students manage to effectively juggle their social life and academics.

## Features

The department of Civil engineering, IIT Roorkee, being the oldest and largest in the country, has over the years produced some of the finest engineers accredited with playing a significant role in various civil engineering projects in India- The Ganga Canal, The Bhakra Nangal Dam, the Indira Gandhi Canal, the construction of Chandigarh, to name a few. Over the years, the department has produced numerous chairmen of the Indian Railways, CPWD, Airport Authority of India, Delhi Metro Rail Corporation, and a few entrepreneurial geniuses such as Mr. Jay Prakash Gaur (JP Associates) and Mr. Rahul Gupta (Rays Experts).

## Future Prospects, Internships and Placements

The faculty of the department conduct high-quality research in diverse fields ranging from building science and technology, structural engineering, and geotechnical engineering to hydraulics and environmental engineering. The professors are easily approachable and supportive to undergrad students who are willing to undertake research projects.

The students of the department have to undergo a mandatory 6-week long internship after the completion of their third year. The students have the option of doing an industry-based internship to gain firsthand knowledge in the construction industry or pursuing a research internship through DAAD, MITACS, or SURA at various universities and labs around the world.

The students of the department get placed in some of the most reputed construction companies in the nation like L&T and Shapoorji Pallonji to name a few. However, placements are not limited to construction firms and students holding interests in other fields may opt for analytical jobs in companies such as Flipkart, Snapdeal, Housing.com, and ICICI Lombard.



## Computer Science and Engineering

The main purpose of the existence of this department is to belittle its adjoining department by offering common courses to the ECE and CS students which then the CS students end up nailing.

Apart from this, it offers a couple of programming courses, AI-r conditioned labs to play Minesweeper on and a sprawling cycle stand that takes pride in its ancient history. Every once in a while, a couple of CS grads get crore plus offers and the news does the rounds in the dailies. Apart from that, there isn't much that goes on round the year.

## Courses and Syllabus

The branch comprises two main components - Computer Science and Computer Engineering. Computer science deals with the theoretical foundations of information and computation, along with practical techniques for the implementation and application of these foundations. In other words, it is the systematic study of algorithmic methods for representing and transforming information, including their theory, design, implementation, application, and efficiency. The roots of computer science extend deeply into mathematics. Computer Engineering, on the other hand, typically focuses on computer hardware and software. It is, in a nutshell, an integration of computer science and electrical engineering. The curriculum covers both aspects.

Subjects like Data Structures and Algorithms, Discrete Structures, Computer Architecture, Operating Systems, and Networking, etc. are vital for a complete understanding of the branch. The writers of the guide would advise the freshmen to master the courses on Programming since almost the entire CSE curriculum depends on it.

## Features

There are wide areas of research that are open for any person who studies CS: Machine Learning (including Subdomains of AI, Robotics, Natural Language Processing), Network Security, Compilers, Cryptography, Mobile Operating Systems, Real-time OSs, Cloud and Distributed Computing, Discrete Mathematics, Programming Languages, Data Mining, Database Management Systems, to name a few. In addition to these, there's the field of Data Analytics, incorporating the concepts of DBMS, Probability, and Statistics, famously known as Big Data.

Computer Science, compared to the other branches of engineering, is a relatively newer field of study. The exponential burst came with the advent of corporate giants like Apple and Microsoft. Contrary to popular belief, its relevance increases day by day. CS grads who know their basics are highly in demand. But, the catch here is precision. You cannot fool or wriggle your way out of any situation. As an engineer, you need to understand and deal with the realities of the problem and find out a viable solution. That takes a lot of study and practice. A job in CSE is only and only dependent upon your ability to find and solve problems.

In the industry, the job descriptions include Software Engineers, Data Analysts, System Programmers, Software Program Managers, and Software Architects. Additionally, if you pursue higher studies (M.S. or Ph.D.), you are also entitled to jobs in Universities and Research Teams in different Companies and organisations .



## Future Prospects, Internships and Placements

Students apply for internships in both industry and academia. During interviews, companies mainly test your ability to code under dire circumstances along with your command over basic Algorithms and Data Structures. The mean salary for CS undergrads in 2021 was around 36 lakhs per annum. The average package is however, an unhelpful quantity, owing to the huge window in the pay package. Competitive Programming is the most celebrated sport in the CS community (not to forget the Cyber Security or Capture the Flag (CTF) contests, and the Data Science challenges which have been gaining popularity of late).



## Data Science & Artificial Intelligence

The students of this branch are referred to as "The AIDS kids, courtesy of mfs" (Mehta Family School, of course). Rumors have it that the only reason to introduce this branch was out of FOMO from other IITs (or to just steal higher AIR students from IIT Guwahati CSE)

You would commonly find these kids flexing their minimal load over other branches and telling how they will make the AI making everyone's job obsolete

## Courses and Syllabus

The first-year courses are similar to other UG departments (Especially the first semester), with mostly interdisciplinary courses in the 2nd semester (but a larger batch means better relative grading, right?)

It's only in 2nd semester that you start going into actual Data Science with courses such as "Applied Linear Algebra" and "Principles of DS and AI" with a sprinkle of interdisciplinary courses like energy engineering and Computer architecture and Organisation.

In 3rd year, you get into the heat with dedicated courses like Reinforcement Learning, Statistical Learning Theory, Distributed Systems, Natural Language Processing, and more. You also get to choose department electives and choose a minor.

4th year is extremely relaxed with your BTech Project, Internship Seminar, and Departmental Electives.

The department electives are divided into four categories: Foundational/Theoretical type, Computer Science Based, Finance/Social Based, and one based on Healthcare/infrastructure

## Features

The best feature of this branch is the latest study material and the recent boom, especially in corporate giants like Microsoft and Google. Since the branch is relatively new, there are no placement statistics available. Still, considering the situation, we can be sure that it will be equivalent, if not greater, to the circuitals like CSE and ECE.

Another advantage is that the course structure is light, the professors are open to suggestions, and the course content is somewhat flexible too. (Although you might have to face the ridicule of other students being referred to as the AIDS branch)

## Future Prospects, Internships and Placements

The prospects of this branch are still up and coming. Especially after the release of GPT3 and GPT4, every corporate giant is trying to incorporate Artificial Intelligence somewhere.

Not to mention the ample research happening in this field, students of this branch will have a field day choosing future careers from corporate jobs to startups to academia.

If you lose interest in the course midway, don't worry since knowledge of other computer science and math fields will allow you to pursue a career in the SDE field too



## Electrical Engineering

The department of Electrical Engineering is strategically at the worst location in IITR. Strategically, because :

- a) It is far from everything of vital importance (SAC and Georgia) and sits directly in front of the Director's house.
- b) If an interdepartmental war breaks out, Electrical department will be hammered by the surrounding superpowers of Mechanical, Civil and ECE departments.

The undergrads of this branch are constantly exposed to age-old electrical machines that make funny sounds when they run. They are also at the receiving ends of requests by fellow bhawan inmates to repair their fans and geysers.

## Courses and Syllabus

Electrical engineering at IITR deals with the study and application of electricity, electronics, and electromagnetism in order to design, construct and maintain products, services, and information systems. The coursework is undoubtedly rigorous but with proper time management and smart decisions you can sail through most of them along with extracurricular activities. Core Electrical subjects include Signal Processing and Instrumentation, Power transmission and distribution, Control System Analysis, Communication Systems, Power Electronics, RF, and Microwaves. Apart from that, there are some similar courses to Computer Science Engineering and Electronics Engineering courses like C++, Microelectronics, etc. The concept of computing along with recent applications of computer-based systems in design, analysis, client operation of power systems, and maintaining quality and security are also included in the course.

## Features

Electrical Engineering graduates could forlong their education by specializing and doing research in fields like Power, Electronics and Drives, Power Systems, Electrical Machines, Control and Instrumentation, Applied Electronics, Embedded Systems, VLSI Design, etc. Many premier educational and research institutions regularly admit electrical engineers as graduate engineer trainees and Management Trainees to work on research projects. Research areas in the branch include Communication and Networking, Power Systems, Signal and Image Processing, Electromagnetics, etc. A good GPA along with a graduate degree from IIT should hold you in good stead while applying for jobs or higher studies.

## Future Prospects, Internships and Placements

There is no dearth of job opportunities in the public or private sectors, such as Electricity Boards, Large Scale Industries, Manufacturing Plants, Power Corporations, Hydro-Electricity sector, etc. EE is a versatile branch where students, with some extra effort can expand their work area into Software, Core Electrical, Electronics as well as Non-Technical Profiles like consulting firms. Prominent companies which recruit Electrical Engineers from the college include: ABB, Bajaj International Private Ltd., Bharat Heavy Electricals Limited (BHEL), PGCIL, IOCL, Trident, Centre for Electronics Design and Technology, Crompton Greaves Limited (CGL), Siemens Ltd., Reliance power Ltd. and non-core companies like Goldman Sachs, Google, etc. And this is just the tip of the iceberg.



## Electronics and Communication Engineering

Situated precisely 46.5 degrees to the right of the ECE circle, this department boasts of many things other than their inappropriately shaped EC tower. The professors of the ECE department are characterised by their fearful, ruthless efficiency and an almost fanatical devotion to surprise quizzes. Since nobody expects their inquisition, the professors are known to declare surprise quizzes beforehand and then surprise the students by not taking any. Although some people say that this department exists only to be belittled by its adjoining department, this is a gross miscalculation as everyone knows that undergrads of this course are the most popular across all years.

## Courses and Syllabus

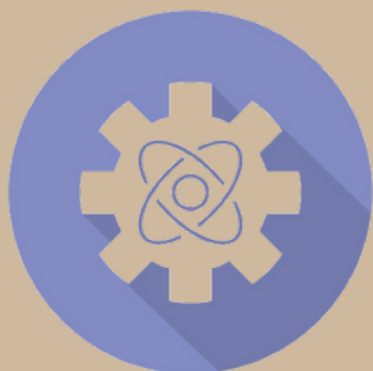
This branch of engineering develops integrated circuits and printed circuit boards that can be used in devices like mobiles, computers, tablets etc. Electronics engineers design, fabricate, maintain, supervise and manufacture electronic devices. The applications are far-reaching, ranging from communication and defence to the entertainment industry. In a nutshell, this branch deals with electronic devices and their software interfaces. The branch in itself is too vast to pick upon specific topics, but Digital logic design, Analog circuits, Signals and Systems, Engineering Electromagnetics, Communication Systems and Techniques, and Digital Signal Processing form the core of the branch. This branch is filled with subjects that require practice to excel at, like Signals and Systems, Electronic Network Theory, Digital Logic and Design to name a few. A strong background in Mathematics (mainly probability and statistics) would definitely help.

## Features

Different fields of research within the branch include Communication Systems, Signals and Image Processing, Microelectronics and VLSI, RF and Microwave Engineering. ECE also opens a whole new spectrum of interdisciplinary research fields, some of which include Mechatronics, Robotics, Biomedical Engineering etc. ECE offers a lot of opportunities to take up projects. Some small projects are included in the course structure. To take up a Departmental Project, the student can go and talk to any faculty member working on their field of interest to guide them on their project idea.

## Future Prospects, Internships and Placements

With a Bachelor's degree in ECE, a student can apply for a job in any of these sectors - Telecommunication, Hardware Manufacturing, Software Engineering/IT, Research & Development, Home Appliance and VLSI design, Television Industry and also the Power sector. The branch offers plenty of internship opportunities. One can get an intern in any field ranging from software development to hardware engineering. One can also apply for internships abroad at various foreign universities. Apart from that, IITR has a number of student groups like the Electronics or Robotics section that give you an opportunity to work on different projects. For those interested in mechatronics or robotics, there are groups like Robocon, ASME, FSAE etc. that participate in various competitions. If working in big groups is not your cup of tea, then there are various competitions like Texas Instruments Innovation Challenge (TIIC), Microsoft Imagine Cup etc. in which you can participate in small teams.



## Engineering Physics

Having previously shared a building with the Mathematics department, both these departments take in young geeks having a JEE rank that could not grant them civil or chemical. The entrance to the Physics department is also regarded by many as a wormhole hidden in plain sight: transporting unsuspecting entrants from a world of joy, togetherness, and masala patties to one of misery, practical records, and where you can't talk inside laboratories.

## Courses and Syllabus

The structure of the course offered at Roorkee consists of a package of standard undergraduate physics courses designed to give a rudimentary understanding of basic and popular areas of physics research to the students. Studies deal with condensed matter physics, optics, nuclear physics and atmospheric and atomic physics. Recent changes have been reflected in new courses being floated, such as those in astrophysics, space technology, nano-systems, biophysics and quantum optics.

However, this being an engineering course rather than a theoretical physics one, the traditional physics courses are bundled along with relevant courses from other disciplines such as those in Signals and Systems, Microprocessors and Peripheral Devices and Semiconductor Devices. Students have the option of deviating even further from the conventional by taking up elective courses such as Digital Image Processing, Data Structures, Remote Sensing, and Digital Signal Processing in their third or fourth years.

## Features

Roorkee's physics department has traditionally held a theoretical stronghold. We have a number of experienced faculty specializing in nuclear physics, condensed matter physics, atmospheric science and atomic physics. The new faculty has brought in experience in fields such as astrophysics, biophysics and solar cell research. There is an upcoming cutting edge lab in quantum optics, supposed to be operational soon, that is expected to produce quality experimental research once functional. Students, especially undergraduates, have been known to participate in the department's research activities. Undergraduates are usually not expected to do research, but there have been instances of students collaborating and even taking the lead on projects leading to publications. The department is usually encouraging such initiatives on the student's part.

## Future Prospects, Internships and Placements

Students, especially undergraduates, have ample opportunities to participate in active research during their summer and winter breaks. A number of summer fellowships have been awarded to students to work at prestigious universities and research institutions, both in India and abroad. Many senior students work with researchers of their choice over the breaks where they are exposed to an

intensive research environment. They bring this experience home to the benefit of their peers. There have been participants in exchange programs like the WISE (DAAD Germany), the SN Bose Scholars Program (USA) the MITACS Globalink Program (Canada), and other fruitful exchanges with some European universities. A number of students also participate in the IAS fellowship program, where they are paired with a leading researcher at an Indian university or institute for the summer. It is also common for students to participate in summer and winter schools and camps in specialized topics. A testament to the efficacy of such programs has been the number of publications that have come out of these projects, assuring us that the students have been exposed to quality research. This experience is vital in helping the undergraduates make an informed choice when opting for graduate school. A great experience working in the lab, or on theoretical or numerical projects has persuaded a number of skeptical students to opt to go to graduate school.

Opportunities for students after graduation are varied. On the physics front, a doctorate degree is a necessity if the students want to be researchers. With the right profile, a Roorkee graduate can make it to top schools in the US and Europe. Recent graduates have made it to top Ivy League schools, and best research groups in Europe. It is also common for students to get graduate positions at top Indian research institutes. The curious mix of courses taught at Roorkee prepares the graduating students for life ahead as a physics researcher.



## Geological and Geophysical Technology

You have probably come across a handful of branches prefixed 'geo' in your information brochure. You might have scurried over a few Google results and taken it as a bunch of alien subjects- magnetotellurics, plate tectonics, stratigraphy, volcanology, invariably dealing with Earth, its composition or development history- devised to fulfill some inscrutable purpose. It is likely you have treated them with close-folded arms, and post allotments, cursed the universe for landing you in a branch that cuts you off from the fancy world of computers and electronics. The department is known to require less working hours and therefore, students have time to pursue other interests.

## Courses and Syllabus

Earth Science is the systematic study of Earth and its various processes- the formation of mountains, occurrences of earthquakes, all of it. Geoscience finds applications in a plethora of scientific fields, from reconstructing the history of Earth to mineral and oil explorations, from expounding the biogeochemical cycling of elements to contributing to environmental conservation. It forms a part of Planetary Science with geoscientists in agencies like NASA now evaluating the feasibility of civilizations in celestial bodies.

The Department of Earth Sciences at IIT Roorkee offers five years of integrated courses in two disciplines: Geological Technology and Geophysical Technology. Geophysics, which employs a wide breadth of physical methods and principles to assess Earth's dynamics, has a greater mathematical edge and frequently incorporates non-core subjects. Geologists are adept at the direct interpretation of geological properties for their various applications .

## Features

Quite likely, in both the branches, all interesting Physics, Chemistry and Maths that you have been accustomed to are held in abeyance for a while, easily surpassed by theoretical subjects. However, develop a slight taste and the branch has a lot to offer. Field trips are an integral component of the course curriculum. The niceties render the structure research-intensive, only racked up by the combat between rising energy demands and growing environmental concerns. The fields of research in the branch can be broadly classified into academic and industrial. Academic research deals with the core subjects like metamorphic, igneous petrology, fluid inclusion, and geochemistry. Industrial research, on the other hand, deals with the application of seismic, well logs, structural geology, sedimentary petrology and stratigraphy.

## Future Prospects, Internships and Placements

Geoscientists play a key role in the oil and gas sector. With the increasing importance of coding on reservoir simulations, the application of artificial neural networks in predicting river fluxes and drainage, and the use of remote sensing and GIS for urban planning and study of distant planets, the field offers unlimited potential for growth. The pool of recruiters at IIT Roorkee includes some of the world's leading oilfield E&P services companies like Schlumberger, Royal Dutch Shell, Cairn India, and PSUs like ONGC. The initial pay scale varies from 7 to 21 lakhs per annum, depending upon the type of job you pursue. Field engineering jobs fill your pockets deeper than the data processing ones but equally emphasize physical fitness. The average salary figures can however be misleading, unduly surged up by a fraction of high-paid ones.



## BS/MS Chemistry

This is a recently introduced branch that offers a thorough insight into chemistry through a 5 year (5th year optional) program.

The students take pride in making people realise that Chemistry and Chemical Engineering are two different department buildings. The people of these species can be found in the labs, frowning over a dozen test tubes, trying to distinguish between the characteristic ammonia smell and the rotten egg smell.

## Courses and Syllabus

Although being a significant part of every student's preparation before coming to the institute, this major branch of science mostly goes ignored by students pursuing their degrees here. This branch deals with subjects like Organic Chemistry, Kinetics, Advanced coordination chemistry and solid state chemistry. A complete perspective on chemistry can be developed through this course.

This branch has introduced a lot of science courses that will help students to get in-depth flavors and essence of quantum, coordination, laboratory, surface, and analytical chemistry under three major domains of chemistry: organic, inorganic and physical chemistry. Various introductory courses like computer programming, environmental science, and psychology are also provided with the goal of helping students to explore other fields.

## Features

The Chemistry Department houses various Undergraduate and Masters' labs that house equipment ranging from simple titrations to advanced spectrometers. The faculty is active in several research areas including Organic Synthesis, Material Science, Polymer Chemistry and Spectroscopy.

## Future Prospects, Internships and Placements

As with other branches, the categories are split into core and non-core. A few students from Masters get placed in core companies whilst many others prefer to undertake research in institutes in India and abroad. The faculty encourages undergraduate research and has notably recommended students to places like Georgia Tech and MIT in the past.





## BS/ MS Economics

Introduced for the first time in 2021 batch, it is a BS-MS Course. It's total duration is 5 years but you can exit in 4 with a BS degree.

The programme is unique as it would help the students to apply various economic principles, theories and models, and understand the technical foundations behind them.

It is also the first and the only UG course of humanities and social sciences department in IIT Roorkee.

## Courses and Syllabus

The first year is like most other courses with core introductory courses and subjects like Introduction to Microeconomics and Macroeconomics, Basic Statistics and Mathematics including Mathematical Methods and Optimisation Techniques.

The second year includes several courses building upon the first year like Advanced Microeconomics, Advanced Macroeconomics, Advanced Statistics and Developmental Economics. It also has courses from other departments like Electrical Sciences and Manufacturing processes. The second year also includes the study of Monetary Economics and Introduction to Econometric Theory.

The third year includes Public Finance, Advanced Econometrics, International Economics among others along with one management and one open elective (Risk modelling, labor economics etc.). Students have to also choose departmental electives.

The 4th year introduces courses like Time Series Analysis, Environmental Economics and Financial Economics. There is a wide range of departmental and non-departmental electives to choose from in this year.

In the fifth year, students have a few Economics courses with seminars and a Dissertation which is divided into 2 stages for the two different semesters.

## Features

There is a robust research environment for Economics, that includes: Microeconomics, Macroeconomics, Behavioural Economics, Developmental Economics and Banking and Finance, Energy Economics, Environmental Economics, Supply Chain among many other available opportunities

Economics people are demanded in the industry for the ability to analyse the situations and predict the most certain future of an individual, a firm or a nation. This makes Economics a must needed subject of study.

## Career prospects

Students after graduating have many roles to choose from the fields of research, finance and consulting, management, industrial organisation, government roles and many other.

The roles like Data Analysts and Data Scientists are most famous amongst students as the course structure provides strong hold on topics like Statistics, Econometrics and

Time Series Analysis along with the adequate mindset required for such roles. In the field of Finance, the industry looks for people with a good understanding of Economics, Mathematics and Finance that are included in the course structure.

People from this branch also look forward to working in Think Tanks, NGOs and Economics research. There are various Government agencies like planning commissions (NITI Aayog), Financial Ministry and many others that look for students with Economics degrees.

## Courses and Syllabus

As with its Engineering counterpart, the structure of the course offered at Roorkee consists of a package of standard undergraduate physics courses designed to give a thorough understanding of most of the basic and popular areas of physics research to the students. Studies deal with condensed matter physics, optics, quantum physics, nuclear physics and atmospheric and atomic physics. Recent changes have been reflected in new courses being floated, such as those in astrophysics, space technology, nano-systems, biophysics and quantum computing. This being a pure science course, the last two fields of study involve a deeper look at core physics courses including Quantum Mechanics, QFT and Statistical Mechanics.

### Features

Roorkee's physics department has traditionally held a theoretical stronghold. We have a number of experienced faculty specializing in nuclear physics, condensed matter physics, atmospheric science and atomic physics. The new faculty has brought in experience in fields such as astrophysics, biophysics and solar cell research. There is an upcoming cutting edge lab in quantum optics, supposed to be operational soon, that is expected to produce quality experimental research once working. Students, especially undergraduates, have been known to participate in the department's research activities. Undergraduates are usually not expected to do research, but there have been instances of students collaborating and even taking the lead on projects leading to publications. The department is usually forthcoming to such initiatives on the student's part.

### Future Prospects, Internships and Placements

Students, especially undergraduates, have ample opportunities to participate in active research during their summer and winter breaks. A number of summer fellowships have been awarded to students to work at prestigious universities and research institutions, both in India and abroad. Many senior students work with the researchers of their choice over the breaks, where they are exposed to an intensive research environment, experience they bring home to the benefit of their fellow students. There have been participants in exchange programs like the WISE (DAAD Germany), the SN Bose Scholars Program



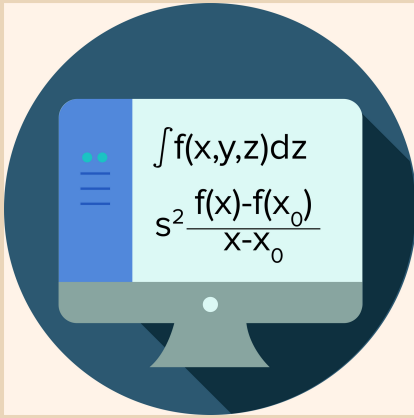
## BS/MS Physics

This branch has had a volatile history and was not offered for 2 years before being recontinued in 2017. It is essentially a bigger brother of Engineering Physics sans the engineering subjects.

Physics students excel in not just research (in their core subjects, that too!), but also in many other facets of college life.

(USA), the Mitacs Globalink Program (Canada), CERN internships and other fruitful exchanges with some European universities. A number of students also participate in the IAS fellowship program, where they are paired with a leading researcher at an Indian university or institute for the summer. It is also common for students to participate in summer and winter schools and camps in specialized topics. A testament to the efficacy of such programs has been the number of publications that have come out of these projects, assuring us that the students have been exposed to quality research. This experience is vital in helping the undergraduates make an informed choice when opting for graduate school. A great experience working in the lab, or on theoretical or numerical projects has persuaded a number of skeptical students to opt to go to graduate school. Opportunities for students after graduation are varied. On the physics front, a doctorate degree is a necessity if the students want to be researchers. With the right profile, a Roorkee graduate can make it to top schools in the US and Europe. Recent graduates have made it to top Ivy League schools, and best research groups in Europe. It is also common for students to get graduate positions at top Indian research institutes. The curious mix of courses taught at Roorkee prepares the graduating students for life ahead as a physics researcher.

## Course Structure



## Mathematics and Computing

Introduced for the first time in the 2021 batch. Technically a replacement course for Int. MSc. Applied Mathematics BS-MS Course. Total duration is 5 years but you can exit in 4 with a BS degree.

Undergrads of this course live up to their 'nerdy kids' stereotype but indulge in a variety of cultural and other (not specified) activities on campus.

First Year has courses similar to other UG departments (Especially in the first sem). The second sem introduces some introductory mathematical courses like elementary real analysis and number theory with a CS course- Data Structures. The second year introduces a lot more academically oriented mathematics courses like Discrete mathematics, complex analysis while also introducing some practical based courses based on application of mathematics like Statistical Machine learning.

Third year has more interdepartmental courses like Database management systems and a management elective. It also has a few cores like Theory of computation, Mathematical modelling and gives an opportunity to choose 2 program electives along with an open elective from any department. Fourth year give a lot more freedom in choosing courses including minor specialisation courses, program electives and core subjects too. Students have an option to trade two program electives for an 8 credit project. Fifth year is mostly the time where the students will work on their thesis (and take up some program electives in their ninth sem).

## Career prospects

The Career prospects of this field include but are not limited to

**IT and Software Dev:** The usual non core which will be aided as this is a circuital branch with certain computer programming courses like Data Structures, Database Management Systems et cetera. An introduction to cryptography as well through courses like Number theory and elective like Mathematical Cryptography. Statistical Machine Learning with certain electives will also help in jobs of similar prospects.

**Core Research:** Courses like Elementary Real analysis, Real Analysis, Complex Analysis, Number Theory and many other courses are oriented to promote academic mathematical Research

**Finance:** Several courses of MnC are oriented for jobs in the field of Finance (especially quantitative analyst (quant)) with electives like "Machine Learning for Finance" and "Financial Risk Management"



## Mechanical Engineering

The Mechanical department was established in 1946. (Sarcasm alert!) This department is mainly known for its path-breaking research, use of fancy technology and tendency to give orgasmic reactions at the sight of any company with a CTC greater than 6 lacs.

### Courses and Syllabus

The bachelor course for Mechanical Engineering at IITR can be broadly divided into the following subjects: Thermal Engineering and Fluids, Manufacturing, and Machine Design & Robotics.

Apart from these subjects, the curriculum also includes introductory courses to the other branches. Since some courses form the foundation for the ones that follow as you move up the ladder, it is advisable to develop a thorough understanding in the subjects.

### Features

The one salient feature of this branch at IITR is the presence of various students groups in the campus who have undertaken projects closely relating to the practical aspects of what you study in the classroom. Team KNOx and IITRMS aim at a full design and fabrication of All Terrain vehicles and Formula cars; SAE and ASHRAE foster the concepts of Automotive Engineering and Thermodynamics; ASME for the robotics and also the newly emerging projects in aerodynamics. Walking into an IIT itself opens the doors to a plethora of career options. While many choose to stay onboard, others exhibit their dexterity at competitive or developmental programming, marketing and finance or realize that working at a consultancy firm is the safest bet.

### Future Prospects, Internships and Placements

One can opt to pursue higher education in India or abroad. A master's degree can be obtained in various disciplines. Some of the research areas pertaining to the branch are Rapid Prototyping, Robotics, Vehicle-to-Vehicle Interaction, Intelligent Automotive, Energy Efficiency/ Hybrid Technologies, INDUSTRIE 4., Smart Structures, etc. A good GPA along with some project undertaking can land you at a top-notch university with little effort.

It is mandatory to do an internship after the third year. However, it is always better to utilize the second-year holidays as well. Internships can be done in the industry or can be of the research

type, which is done under the guidance of a professor. Companies such as ITC, Shell, Schlumberger, and Tata Steel recruit interns from the college while you can always apply to any firm on the campus.

One particular perk of the internship is that you may end up with a job offer right after your work review, which saves you from the agonizing process of placements, which, for most of the candidates turns out to be a blood pressure escalating affair. You can also try for a foreign intern in countries such as Germany, Canada, Japan, and the USA with the help of various internship programs.

## Courses and Syllabus

The ability to understand and manipulate materials and their properties is a key factor in any industrial process or technology. Metallurgy is a domain of materials engineering that studies the physical and chemical behaviour of metallic elements, their intermetallic compounds and their mixtures called alloys. With subjects like Structural Metallurgy, Thermodynamics, Material Kinetics and Metal Casting and Joining, a holistic perspective on dealing with materials can be achieved through this course.

## Features

The Metallurgical and Materials Engineering Department is one of the most active departments in IITR, with multiple societies such as METES & Material Advantage Student Chapter functional here, comprising of both students and faculty. Additionally, Material Science has immense scope for research, and many graduates opt for Masters or PhDs in the subject of their choice after graduation. A lot of research is undertaken by the professors, in the department, in the self sufficient laboratories. 330+ scores in GRE along with impeccable research profiles have taken our graduates to top research laboratories such as those in Stanford University, MIT, University of Wisconsin- Madison, Princeton etc.

## Future Prospects, Internships and Placements

Broadly classified into three categories, namely, research, industrial and non-core, students can pursue their interests in this period to align their professional choices. Programs such as MITACS (Canada) and DAAD (Germany) provide well articulated research options abroad. Since these programs are associated with high GPA caps, people opt for cold-mailing professors across continents with similar research interests and enough funding, for the coveted research experience. A faction of students look upon steel giants and other associated industries to grab any opening as a summer trainee. Apart from core ventures, people tend to go for internships in the finance sector, consultancies and firms for designing & advertisements as well. As far as the campus placements are considered, students are eligible for almost all data analytics and consultancy firms that visit in the 20-day window when the campus, quite ironically, reflects cold-war & bloodshed. For some years now, Roorkee has been witness to scanty participation by core industries for the Metallurgy and Materials Engineering Dept., but the numbers are expected to turnaround soon. People are also placed in consultancies such as ZS Associates, i3 consulting and several found a desk under the roof of IT houses such as Wipro & TCS.



## Metallurgy and Materials Engineering

Meta, as it is termed in IITR lingo, is better known as the chemical engineering department's poorer cousin. The metallurgical department undergrads are identified by their strong indulgence in the affairs of the institute and anything which isn't even remotely related to their branch.





## Production and Industrial Engineering

Production and Industrial Engineering (P&I) is a sister branch of Mechanical Engineering. The undergrads are basically Mechanical Engineers in making, only with an easier lifestyle. (This is a good thing, don't listen to your mechanical engineering friends.)

### Courses and Syllabus

Production and Industrial Engineering, as the name suggests, comprises of two different specializations. Production Engineering involves study and application of various manufacturing processes. There are practical and theoretical courses on Manufacturing Techniques namely Forming, Material Removal and Finishing processes and Tool Engineering. The course content is more theoretical rather than mathematical. Industrial Engineering covers a very wide variety of subjects. It revolves around optimizing the time and resources available for a firm and running their operations. The subjects pertaining to the same are more mathematically intense than Production. Some courses in the curriculum are borrowed from Mechanical Engineering, like Machine Drawing, Thermodynamics, Fluid Dynamics and Theory of Machines, to name a few.

### Features

An industrial engineer has wide knowledge of engineering practices and is aware of management challenges related to production. Most manufacturing houses look out for engineers who specialize in this field so as to reduce cost, increase efficiency and make their products marketable in this competitive era. Among the older IITs, P&I, as a branch, is offered only in IIT Delhi and IIT Roorkee, along with a similar branch in IIT Kharagpur (Manufacturing Engineering), making it all the more unique. On an average the workload is 20 hours per week, which gives a lot of time to the students to engage in extracurricular activities in the institute and carry out any research related activities in his/her area of interest.

### Future Prospects, Internships and Placements

Students can, post their undergraduate studies, opt for MBA in Operations (or in general) or pursue MS in any field of Industrial Engineering (Analytics, Optimization, Facilities Systems and Network Planning, Stochastic Modelling and Simulation, Health Systems, Manufacturing, SCM, Operations Research). For those interested in Production, the fields of research are mostly centered around manufacturing processes and their optimization, including Advanced Machining, Ultrasonic Machining, Electro Discharge Machining, Submerged Arc Welding, Computer Numerically Controlled Machining to name a few. A lucky few get to do a fully funded research internship in Germany via DAAD, in Canada via MITACS, and in Japan via HondaYES+. Most students try to widen their

prospects by studying business and finance related disciplines so as to get internships and jobs in those fields. Additionally, as far as campus recruitments are concerned, PI students are eligible for almost all data-analytic and consultancy firms that visit the campus. Jobs opportunities are not scarce, but again, there is no free lunch. Students in this branch enjoy the versatility of choice as they get placed in companies across various sectors: Oil and Gas (Shell, Schlumberger), FMCG (ITC), Automotive (TATA Motors, Hero MotoCorp, Anand Automotive, VE Commercials, Mahindra & Mahindra), eCommerce (Flipkart, Snapdeal), IT (Oracle, Wipro) and other companies visiting the campus offering roles in various domains.

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