

# MINING ENGINEERING TECHNOLOGY, BTECH

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The modern mining industry is concerned with the stewardship and recovery of the earth's mineral resources in an economic and sustainable manner, while also adhering to ethical and social values. Mining professionals have to be technically proficient, work safely, have business and management skills, recognize and mitigate negative environmental effects, understand the interests of local communities, and design for sustainability. The Bachelor of Mining Engineering Technology curriculum has been designed to provide technical, managerial, and sustainability skills, as well as develop an understanding of the business of mining in terms of economics, finance, and people. Recognizing that technical competence is key to the business of mining, these competencies will be emphasized by providing the necessary fundamental background in science and mathematics, and reinforced through a two-week hands-on field school placement, occurring in the summer of each year (one in Kingston, the other in Timmins), which will also serve to enhance the development of applied skills and theoretical concepts. Ultimately, the curriculum is designed to produce experienced mining professionals with technical hands-on communication and business skills, sensitive to the values of society, and with an ability to adapt to the future needs of the industry.

Progression:

- All curriculum may be completed at either a full-time or part-time pace.
- Courses are group-paced, delivered asynchronously, and are 12 weeks in length.
- Upon enrolment, students must complete a customized bridge curriculum (offered via distance delivery), before progressing into Year 3 of the program.
- Years 3 and 4 will each contain 12 courses (also offered via distance delivery - pending curriculum committee approval).
- Upon completion of each year's curriculum, students will then be required to complete a two-week, laboratory intensive field placement, consisting of a series of labs based on the year's curriculum.

## Program

- Mining Engineering Technology, BTech (<https://queensu-ca-public.courseleaf.com/engineering-applied-sciences/academic-plans/mining-engineering-technology-btech/mining-engineering-technology-btech/>)

## Courses

### MNTC P01 Engineering Mathematics Units: 3.00

This course provides a detailed introduction to the fundamentals of calculus and linear algebra as applied to engineering applications. The purpose of the course is to provide a mathematical foundation for students pursuing upper-year engineering-related courses. The course covers topics such as derivatives, implicit differentiation, partial derivatives, integrals, first-order and higher-order linear ordinary differential equations, fundamentals of Laplace transforms, matrices and matrix inverses, solving systems of linear equations, vector spaces, orthogonality, and determinants. Topics are introduced by way of engineering examples. Available Online.

**Requirements:** Must be registered in the BTECH program or BASC. Prerequisite: MNTC P03, MNTC P04.

**Offering Faculty:** Fac of Engineering Appl Sci

### MNTC P02 Mining Geology Units: 3.00

This course provides an overview of geological eras, basic geological structures, mineralogy and mapping technologies as an entry-level course in the Bachelor of Mining Engineering Technology program. The course material is a combination of short videos, required readings and learning activities. Available Online.

**Requirements:** Must be registered in BTECH or BASC

**Offering Faculty:** Fac of Engineering Appl Sci

### MNTC P03 Foundational Mathematics Units: 3.00

This course investigates the properties of polynomial, rational, logarithmic, and trigonometric functions. It develops techniques for combining functions and broadens understanding of rates of change while exploring how functions model real-world contexts. Limits of functions and introductory vector manipulation will also be explored. The course content is presented in a series of purpose-built videos and optional readings. There is an emphasis on time on task in this course and to encourage you to practice your skills, there are graded activities provided each week. Available Online.

**Requirements:** Must be registered in BTECH program or BASC

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC P04 Calculus Units: 3.00**

Functions, limits, derivatives; optimization, rate problems, exponentials, logarithms, inverse trigonometric functions; exponential growth as an example of a differential equation. Fundamental Theorem of Calculus, Riemann integral; applications to problems involving areas, volumes, mass, charge, work, etc. Some integration techniques. Available Online.

**Requirements:** Must be registered in the BTECH Program or BASC. Prerequisite: MNTC P03.

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC P05 Foundational Physics Units: 3.00**

This course serves as a bridge course for students entering the Bachelor of Mining Engineering Technology program from a college diploma program or the workforce. The concepts explored provide learners with the experience and skills in physics that will be necessary for future technical courses in engineering. The course is comprised of a combination of videos, readings and learning activities. Assignments are used to demonstrate proficiency in Newtonian mechanics and electric circuits. Available Online.

**Requirements:** Must be registered in BTECH program or BASC

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC P06 Foundational Chemistry Units: 3.00**

This course enables students to deepen their understanding of chemistry through the study of the structure and properties of matter, energy changes and rates of reaction, basic organic chemistry, equilibrium in chemical systems, and electrochemistry. Students will further develop their problem-solving and investigation skills as they investigate chemical processes, and this course will refine their ability to communicate scientific information. Available Online.

**Requirements:** Must be registered in BTECH program or BASC

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC P07 Surveying Principles Units: 3.00**

This course introduces learners to the fundamental principles of surveying. Learners will develop transferable survey computation skills that can be applied using various technologies in diverse environments. In this course, learners will become familiar with differential leveling techniques and basic measurement of angles and distances including calculation techniques. Principles of error propagation and error analysis are also introduced. Finally, a study of modern survey equipment, related concepts and terminology, including Total Stations, Data Collectors, and GPS mapping, will provide learners with an understanding of the current technologies being used in industry today. Available Online.

**Requirements:** Must be registered in BTECH program or BASC

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 301 Technical Writing and Communication Units: 3.00**

This course focuses on the principles and practical applications of technical and business communication. Students apply effective writing strategies to address a variety of audiences. Students plan, outline, write, and revise reader-centered documents and presentations that relate to forms and contexts they will encounter in professional practice. Available online

**Requirements:** Must be registered in the BTECH program, or BASC and MNTC P05.

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 302 Engineering Physics Units: 3.00**

This course further develops physical concepts of mechanics and electromagnetism in the context of engineering applications. The first part of the course focuses on the mechanics of solid materials, building upon knowledge of rigid-body mechanics and introducing students to the concepts of material strength and elastic deformation. These concepts will be applied to structural members such as rods, columns, shafts, and beams, with loading conditions such as tension, compression, bending, and torsion. The second part of the course focuses on basic direct-current (DC) electrical circuitry and components including electric motors. Students will study concepts such as voltage, current, resistance, capacitance, and inductance. Simple circuit analysis using Kirchoff's laws will be presented, and the sizing and integration of electric motors both electrically and mechanically will be introduced. Available Online.

**Requirements:** Must be registered in the BTECH program, or BASC and MNTC P05.

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 303 Engineering Chemistry Units: 3.00**

The focus of this course is to survey chemical processes and demonstrate its relationship to current practices in mining technology. Students will examine chemical reactions in terms of mass relationships, chemical equations, chemical equilibrium and acid/base reactions concerning aqueous solutions. The examination of the laws of thermodynamics and the behaviour of gases will be explored to provide the necessary background for calculations applied to ideal and non-ideal vapours and liquids. Principles of chemical kinetics and electrochemical reactions will also be studied. Students will have an opportunity to expand their knowledge of organic chemistry to include properties and reactions of functional groups, naming and recognizing key organic structures and apply this knowledge to hydrometallurgy. Special emphasis will be placed upon chemical extraction methods, instrumental analysis, data manipulation and interpretation of key analytes of interest to the mining industry. Available Online.

**Requirements:** Must be registered in BTECH or, and P06

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 304 Applied Metrology and Data Analysis Units: 3.00**

The objective of this course is to offer students an introduction to some of the primary tools and techniques of contemporary instrumentation and analysis. An introduction to signal analysis, data acquisition, sampling and quantization, as well as the fundamental statistical techniques necessary to process and analyze measured data with uncertainty is given. The course focuses on applied methods and draws on several examples that demonstrate the use of sensors and data acquisition in mining. Available Online.

**Requirements:** Must be registered in BTECH or BASC, MNTC P01, MNTC P05, or APSC 111, APSC 112, APSC 171, APSC, 172, and APSC 174

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 305 Introduction to Mining Units: 4.00**

This course presents an overview of the stages of mining, from exploration and prospecting, through development, exploitation, and finally closure and reclamation. Students are introduced to mine financing, methods and design (both surface and underground), mining operations and planning, services (e.g., rock mechanics, ventilation, drilling and blasting), mineral processing, mining equipment and technologies, as well as social and environmental challenges. Case studies and examples are used to illustrate the fundamentals. Available Online.

**Requirements:** Must be registered in BTECH or BASC, and MNTC P02 or APSC 151

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 306 Mineral Processing Unit Operations Units: 3.00**

This course focuses on unit operations of mineral processing. Mineral separation processes of a physical and physicochemical nature are studied. Topics include size reduction, classification, flotation, flocculation, gravity concentration, magnetic, electrostatic separations and dewatering. Surface phenomena involving fine particle processing, reagent classifications, flotation machines and circuits, plant practice in ore flotation are discussed. The course content is presented in a series of purpose-built videos and optional material. There is an emphasis on project-based team work in this course. Your instructor will form the Teams at the beginning of Week 2 and the Teams will be kept the same for all three projects during the semester. Available Online

**Requirements:** Must be registered in the BTECH program, or BASC, Prerequisite: MNTC 303 or APSC 131, and APSC 132

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 307 Geomechanics and Ground Units: 4.00**

Rock engineering deals with the design of excavations in rock. In this course, methods of characterizing rock masses will be reviewed with the objective of estimating rock mass strength. This will include field investigation methods and laboratory testing. Methods of estimating and measuring in situ stress conditions will be described. Analytical and numerical methods of assessing stresses around mining excavations are reviewed, with emphasis on how to select appropriate methods of stress analysis. Building on these elements, methods of stability analysis are presented for both open pit and underground mine design applications. Available Online.

**Requirements:** Prerequisite: MNTC 302, or APSC 182 Must be registered in the BTECH program, or BASC

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 310 Mining and Society Units: 3.00**

This course takes a look at the social, economic, environmental, ethical, and technical issues facing the mining industry. An introduction to the mining industry's relation to society will explore the changing context of the mining industry and its evolving practice, identify socio-environmental issues, and describe how governments attempt to regulate the industry. A brief assessment of the concept of corporate social responsibility will assess society need for proper industrial stewardship and identify key roles mining corporations play within their communities. Finally, the course will explore the details of mineral rights and claims, including a review of relevant cultural issues and identification of major stakeholders involved in the process. Students will discuss the practical challenges related to a company's social license to operate. Available Online.

**Requirements:** MNTC P02 or APSC 151. Must be registered in the BTECH program, or BASC

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 311 Ore Body Modelling and Resource Estimation Units: 4.50**

This course presents a basic introduction to the use of classical and geostatistical estimation techniques for mineral resource estimation. Students will learn to recognize the geological influences to ore body modelling, apply various estimation methods, produce mineralization reports, and classify the mineral resources and reserves according to accepted internationally recognized methods. The course will also include basic ore exploration and sampling concepts. Available Online.

**Requirements:** Prerequisite: MNTC 304, MNTC 305 or APSC 151. Must be registered in the BTECH program or BASC.

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 312 Business Law and Ethics Units: 3.00**

This course is intended to provide the student with a solid general knowledge of Business Law and Ethics. The course will cover core areas of the law, including the nature and structure of the Canadian justice system, contract, intellectual property, and tort law, as well as introduce concepts such as professional liability and ethics and the professions. Available Online.

**Requirements:** Prerequisite: MNTC 301. Must be registered in the BTECH program.

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 313 Introduction to Programming Units: 3.00**

Students will be introduced to the fundamental concepts of computer programming using both C/C++ and MATLAB. The course will teach computer programming with a focus on practical applications for analyzing data and solving practical mathematical problems. Topics will include basic components of a computer (both hardware and software), memory and variables, expressions, selection structures, loops, arrays, functions, and commonly used algorithms such as sorting and searching. At the end of the course, students will be able to apply computer programming skills to assist in both design and analysis for real-life engineering applications.. Available Online.

**Requirements:** Must be registered in BTECH or BASC, MNTC P01

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 314 Drilling and Blasting Units: 4.00**

The purpose of the course is to introduce commercial explosives technology and examine blast design and its outcomes. The students will be taught principles of commercial explosives engineering, including detonation theory, calculation of energy and products of detonation, prediction of explosives performance and sensitivity, methods of measuring, predicting and controlling rock fragmentation, throw, damage, vibration, flyrock and air blast and will apply their knowledge to design blasts for open cast and underground operations for both construction and mining applications. Recognizing that drilling is related to blasting, the course will introduce rock breakage by mechanical means as applied to drilling, examine parameters affecting drill performance, and choose drilling equipment for various mining methods. Available Online.

**Requirements:** Must be registered in BTECH or BASC, MNTC 305 or APSC 111, APSC 112, APSC 171, APSC 172, APSC 174 and APSC 182

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 316 Ventilation and Hydraulics Units: 4.00**

This course will provide an overview of fluid mechanics in order to provide a solid foundation for mine ventilation and mine hydraulics. Students will be able to perform ventilation surveys, analyze existing ventilation networks and design new ventilation networks in accordance with mine regulations and design criteria. New technology for saving energy and reducing emissions will be explored. Mine hydraulics topics such as mine service water distribution, mine drainage and dewatering and backfill distribution will be discussed. Students will be able to perform pipe network analyses and select the appropriate pumps for these applications. Available Online.

**Requirements:** Must be registered in BTECH or BASC.

Prerequisite: MNTC 302, MNTC 304, MNTC 305 or APSC 111, APSC 112, APSC 151, APSC 171, APSC 172, and APSC 174

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 399 Field School I (on site) Units: 5.00**

Field School I provides a hands-on laboratory experience for fields related to the third year curriculum. Field school modules include an introduction to laboratory techniques and data analysis, rock mechanics, blasting technology, and mineral processing. Students will develop practical skills both in laboratory and realistic field scenarios. A focus on occupational health and safety is emphasized throughout.

**Requirements:** Prerequisite: MNTC 301, MNTC 302, MNTC 303, MNTC 304, MNTC 305, MNTC 307, MNTC 316. Must be registered in the BTECH program.

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 408 Mine Health and Safety Units: 3.00**

This course is designed to provide knowledge about industrial health and safety practices, in general, and to relate their applications to the mining industry, in particular. The course will identify fundamental industrial physical and chemical (nontoxicological) hazards and risks and review mitigation strategies. Foundational to the course is the analysis of how a typical mine builds a safety organization. The course will examine the processes and the people that comprise award winning safety programs at top performing mining organizations. Students will explore how to design, organize, implement, and maintain a world class safety program as adapted to the mining environment in today's market. How corporate behavior policies ensure adherence to safe work practices and how risk-based safety procedures will lead to performing a job safely will be discussed. The benefits and challenges of instituting and sustaining a "goal zero" type safety culture will be summarized. Available Online.

**Requirements:** Must be registered in BTECH or BASC.

Prerequisites: MNTC 305, or APSC 151

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 409 Mineral Economics Units: 3.50**

Mining companies develop projects and operate mines as part of a global minerals industry. This course first sets the global context, reviewing the history of mineral economics, the nature and components of mineral supply and demand, pricing and markets, and aspects of their role in the global economy. The impact of government policies and international treaties on mining companies and projects is discussed. Building blocks of relevant economic concepts and financial tools are reviewed and applied to structured problems. The estimation of mineral resources and mineral reserves, the feasibility assessment process, and the disclosure of the results of work in these areas under National Instrument 43-101, are reviewed. The valuation of companies and evaluation of projects is covered, as are approaches to addressing risk and uncertainty. Sources and types of funding for companies and projects are introduced. Throughout the course, ways in which sustainability is increasingly being reflected in activities studied in this course are highlighted.

**Requirements:** Must be registered in BTECH or BASC.

Prerequisite: APSC 221 and MNTC 305 or permission of the Mining Department

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 413 Surface Mine Design Units: 4.00**

This course presents a comprehensive overview of the principal components of surface mine design. Topics include pit limit analysis and economic optimization, haul road design, blast design, and basic stability calculations. Equipment selection and application and mine scheduling techniques will be introduced, including dragline applications. The focus will be on the practical application of design techniques to mine planning, and on the available equipment and methods for field monitoring to provide effective design feedback and support safe operations. Available Online.

**Requirements:** Must be registered in the BTECH program or BASC. Prerequisite: MNTC 305, MNTC 307, MNTC 311, MNTC 314.

**Offering Faculty:** Fac of Engineering Appl Sci





#### **MNTC 414 Underground Mine Planning Units: 4.00**

The objective of mine planning is to produce a plan for the extraction of a mineral resource that can be executed safely and for a profit. In this course students will demonstrate that the practice of mine planning varies along a spectrum from long range planning through to short term planning with the distinguishing factor being the required level of detail in the mine plan. In the context of long term planning, students will study underground mine design principles such as mining method selection, mine design methodology, mine scheduling and mineral reserves. A progression towards short term planning will lead to the exploration of topics including underground drill and blast design, ground support requirements, ventilation, backfill and reconciliation. Modern mine planning practices involve the application of technology to facilitate mine design, optimization and scheduling. These techniques will be discussed and some of the tools being used in the mining industry will be used in this course. Available Online.

**Requirements:** Prerequisite: MNTC 305, MNTC 307, MNTC 311, MNTC 314. Must be registered in the BTECH or BASC program, or the Undergraduate Certificate in Mining Technologies, or permission of the Department.

**Offering Faculty:** Fac of Engineering Appl Sci

#### **MNTC 415 Metal Extraction Processes Units: 4.00**

This course covers the fundamental and practical applications of metal extraction processes. An introduction to the chemical production of metals will be provided. Basic processing concepts of hydrometallurgical, pyrometallurgical and electrometallurgical unit operations will be discussed. The properties of solutions relevant to metal extraction are reviewed. Fundamentals of mass and heat balances in metallurgical processes will be covered. Some metal production flowsheets are utilized to illustrate the integration of unit processes required for metal extraction. Available Online.

**Requirements:** Must be registered in the BTECH program or BASC. Prerequisite: MNTC 303, MNTC 306 or APSC 131, APSC 132, and APSC 151

**Offering Faculty:** Fac of Engineering Appl Sci

#### **MNTC 418 Sustainability and the Environment Units: 3.00**

This course describes the evolution of policies, operational procedures, and management systems related to sustainability and the social, economic, environmental, ethical, and technical design challenges facing the mining industry. Students will be introduced to a range of complex situations with significant sustainability implications that need to be addressed responsibly during the life cycle of a mine, such as resource, water, and waste management, mining -community relationships, mine closure and rehabilitation, as well as a mine closure's community and environmental implications. Available Online.

**Requirements:** Must be registered in the BTECH program or BASC. Prerequisite: MNTC 305, or APSC 131, APSC 132, and APSC 151

**Offering Faculty:** Fac of Engineering Appl Sci

#### **MNTC 419 Mine Supervision and Project Management Units: 3.00**

This course presents an introduction to mine supervision; covering the roles and responsibilities of the industrial supervisor including health and safety; technical skills and knowledge and effective communications with different stakeholder levels from front line workers to senior management. The second part of the course will introduce key concepts related to project management including the role of the project manager, identifying requirements and balancing of competing project constraints which include, but are not limited to, scope, schedule, cost, quality, and risk. Available Online.

**Requirements:** Must be registered in the BTECH program or BASC. Prerequisite: MNTC 305 or APSC 221.

**Offering Faculty:** Fac of Engineering Appl Sci

#### **MNTC 420 Physical Asset Management Units: 3.00**

This course represents an introduction to reliability and maintenance of mining-related equipment, encompassing both mobile fleets and static equipment, including processing plants. It introduces the primary types of maintenance policies and key performance indicators for reliability and maintenance. Analytical tools for resource allocation and prioritization, as well as an integrated methodology for developing maintenance strategies are covered. Available Online.

**Requirements:** Must be registered in the BTECH program or BASC. Prerequisites: MNTC 302 and MNTC 304, or APSC 171, APSC 172, APSC 182

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 421 Technology and Innovation Units: 3.00**

Technology and innovation are driving forces behind modernization of the mining industry. This course presents a review of major technological accomplishments, as well as a methodology and approach to developing innovations that go from a blank sheet of paper to large-scale industrial deployments. Available Online.

**Requirements:** Must be registered in the BTECH Program or BASC. Prerequisite: MNTC 301 or APSC 151

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 422 Soft Rock Mining and Processing Units: 3.00**

This course describes the industrial mining practices associated with a number of industrial minerals. A major emphasis of the course on quarry mining operations related to the major mineral and aggregate industries will be explored. Topics will cover resource definition, quarry planning and design, extraction, and processing of materials. Details for each topic include marketing, transportation, source geology, typical operations, mining, processing, customers, and specifications. Available Online.

**Requirements:** Prerequisite: MNTC 305, MNTC 306, MNTC 307. Must be in the BTECH program

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 423 Geomatics Units: 3.00**

This course introduces students to the fundamentals of mine surveying. Basic measurement and calculation techniques are used to measure distances, elevation changes, and coordinates. The principles of measurement theory, as well as error propagation and analysis are explored. The course will include a detailed review of modern survey technologies such as total stations, LiDar, and Global Navigational Surveying System (GNSS) mapping, and their applications being used in industry today. Available Online.

**Requirements:** Must be registered in the BTECH program or BASC. Prerequisite: MNTC 304, and MNTC 305

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 425 Ore Body Modelling and Resource Estimation Units: 3.00**

This course presents a basic introduction to the use of classical and geostatistical estimation techniques for mineral resource estimation. Students will learn to recognize the geological influences to ore body modelling, apply various estimation methods, produce mineralization reports, and classify the mineral resources and reserves according to accepted internationally recognized methods. The course will also include basic ore exploration and sampling concepts.

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 498 Capstone Project Units: 3.00**

The objective of this course is to further develop the student's design, innovation, and professional skills. Working in teams, students will engage in a mining-related real-world design project. Design processes will be applied from problem definition, scheduling, through to exception and validation. Professional engineering skills such as communication, teamwork, project management techniques, engineering economics, ethics, and safety will be integral to the project. The course will culminate in the production of an engineering design report and video presentation of the design. Available Online.

**Offering Faculty:** Fac of Engineering Appl Sci

**MNTC 499 Field School II (on site) Units: 5.00**

Field School II builds upon the hands-on laboratory experience begun in Field School I. Modules will include a study of mineral processing unit operations, metal extraction processes, as well as drilling and blasting techniques. Students will develop basic laboratory analytical skills both in lab and field sessions. A focus on safety and occupational health will be maintained throughout. Available Online.

**Requirements:** Prerequisite: MNTC 301, MNTC 302, MNTC 303, MNTC 306, MNTC 314, MNTC 408, MNTC 415, and MNTC 423. Must be registered in the BTECH program

**Offering Faculty:** Fac of Engineering Appl Sci