

# GENERAL ENGINEERING (GNG)

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## **GNG 1102 Fundamentals of Computer Hardware (2 units)**

Basic concepts of computer organization: introduction to logic circuits, machine language, representation of data and assembly language. Virtual machines, interpretation, compilation.

**Course Component:** Laboratory, Lecture

The courses GNG 1102, CSI 1101, ELG 1100 cannot be combined for units.

## **GNG 1103 Engineering Design (3 units)**

A hands-on, team-based introduction to engineering design for engineers and computer scientists. Topics include design thinking, engineering design process, prototyping, engineering economics, safety, ethics and project management.

**Course Component:** Laboratory, Lecture

## **GNG 1105 Engineering Mechanics (3 units)**

Concepts of engineering mechanics. Statics of particles and rigid bodies. Free body diagrams. Simple structures, including trusses, frames and machines. Rectilinear and curvilinear motion.

**Course Component:** Lecture, Tutorial

Prerequisite: Physics 4U, advanced functions and Introductory Calculus 4U or equivalent

## **GNG 1106 Fundamentals of Engineering Computation (3 units)**

Introduction to computer systems. Problem solving for engineering case studies. Emphasis is on the design of algorithms and their implementation for solving engineering problems using C. Introduction to Visual Basic.

**Course Component:** Laboratory, Lecture

The courses GNG1106, ITI1120, ITI1220, CSI1301, CSI1306, CSI1303, CSI1308, CSI1390 cannot be combined for units.

## **GNG 1502 Notions fondamentales de matériel des ordinateurs (2 crédits)**

Introduction à la structure des ordinateurs: circuits logiques, langage machines, représentation des données et assembleur. Les machines virtuelles, interprétation et compilation.

**Volet :** Laboratoire, Cours magistral

Les crédits de GNG 1502 ne peuvent pas être additionnés à ceux de CSI 1501 ou ELG 1500.

## **GNG 1503 Génie de la conception (3 crédits)**

Introduction au génie de la conception pour les ingénieurs et les informaticiens. Expérience pratique et travaux en équipe. Les sujets traités comprennent l'approche conceptuelle, le processus de conception, le prototypage, l'économie d'ingénierie, la sécurité, l'éthique et la gestion de projet.

**Volet :** Laboratoire, Cours magistral

## **GNG 1505 Mécanique pour ingénieurs (3 crédits)**

Les concepts de la mécanique. Statique des points matériels et des corps rigides. Schéma du corps isolé. Structures, incluant les treillis, et les mécanismes. Mouvements rectiligne et curviligne.

**Volet :** Cours magistral, Tutoriel

Préalable: Physique 4U, fonctions avancées et introduction au calcul différentiel 4U ou l'équivalent

## **GNG 1506 Notions fondamentales du traitement de l'information en génie (3 crédits)**

Introduction aux systèmes de traitement de l'information. Résolution de problèmes liés à des études de cas en génie. L'accent est mis sur la conception d'algorithmes pour résoudre des problèmes en génie ainsi que leur réalisation en utilisant le langage de programmation C. Introduction à Visual Basic.

**Volet :** Laboratoire, Cours magistral

Les cours GNG1506, ITI1520, ITI1620, CSI1701, CSI1706, CSI1703, CSI1708, CSI1790 ne peuvent être combinés pour l'obtention de crédits de cours.

## **GNG 2100 Topics for Engineers (3 units)**

**Course Component:** Lecture

Prerequisite: Permission of the Faculty.

## **GNG 2101 Introduction to Product Development and Management for Engineers and Computer Scientists (3 units)**

A hands-on, team-based introduction to product development and management principles for engineers and computer scientists and their impact on social and economic aspects of engineering practice. Topics include creativity and innovation product development process, engineering project management, market evaluation and identification, engineering economics, technology entrepreneurship.

**Course Component:** Laboratory, Lecture

## **GNG 2500 Sujets choisis pour les ingénieurs (3 crédits)**

**Volet :** Cours magistral

Préalable : Permission de la Faculté.

## **GNG 2501 Introduction à la gestion et au développement de produits en génie et en informatique (3 crédits)**

Introduction à la gestion et au développement de produits en génie et en informatique par la pratique et le travail en équipe. Impacts sociaux et économiques. Créativité et innovation, processus du développement de produits, gestion de projet d'ingénierie, évaluation et identification de marché, ingénierie économique, et entrepreneuriat technologique.

**Volet :** Laboratoire, Cours magistral

## **GNG 3100 Selected Topics in Engineering I (3 units)**

**Course Component:** Lecture

Permission of the Department is required.

## **GNG 3500 Thèmes choisis en génie I (3 crédits)**

**Volet :** Cours magistral

Préalable : Permission de la Faculté.

## **GNG 4100 Selected Topics in Engineering II (3 units)**

**Course Component:** Lecture

Prerequisite : Permission of the Faculty.

## **GNG 4101 Selected Topics in Engineering III (3 units)**

Selected topics in Engineering.

**Course Component:** Laboratory, Lecture

Permission of the Faculty of Engineering.

## **GNG 4120 Technology Entrepreneurship for Engineers and Computer Scientists (3 units)**

Hands-on introduction to the many dimensions of starting and growing a technology company. How to evaluate market opportunities, develop a product that customers need, raise capital and build a winning team. Skills and tools to turn technical ideas into profitable sustainable businesses.

**Course Component:** Lecture

**GNG 4128 Introduction to Nuclear Engineering (3 units)**

Review of atoms and nuclei. Interactions of radiation with matter. Nuclear reactions. Radioactivity, fission and fusion reactors. Nuclear fuel reserves and resources. Nuclear reactors and nuclear power. Neutron diffusion and moderation. Nuclear reactor theory. Heat removal from nuclear reactors. Energy production and distribution. Radioactive waste disposal. Radiation protection. Reactor licensing, safety and the environment. Various applications.

**Course Component:** Lecture

Prerequisites: 54 university units.

**GNG 4170 Engineering Law (3 units)**

Basic features of laws and practice relating to contracts, agency, property, water rights, forms of business organizations, sales, insurance, utilities, labour, government regulation of business, negotiable instruments, workers' compensation, liens, bankruptcy, patents, copyrights, trademarks; ethical responsibilities, professional registration; special emphasis on contract documents used on construction work.

**Course Component:** Lecture

**GNG 4171 Intellectual Property and Technology Law for Engineers (3 units)**

Trade secrets and confidential information. Patents. Biotechnology. E-commerce and other business methods. Patent application preparation and examination. Novelty and infringement analysis. Patent protection worldwide. Trademarks and internet domain names. Copyright, with an emphasis on the law of copyright in computer software and on the internet. Industrial design and the protection of integrated circuit topographies.

**Course Component:** Lecture

**GNG 4500 Thèmes choisis en génie II (3 crédits)**

**Volet :** Cours magistral

Préalable : Permission de la Faculté.

**GNG 4501 Thèmes choisis en génie III (3 crédits)**

Thèmes choisis en génie.

**Volet :** Laboratoire, Cours magistral

Permission de la Faculté de génie.

**GNG 4520 Entrepreneurat technologique pour ingénieurs et informaticiens (3 crédits)**

Introduction pratique aux multiples dimensions du démarrage et de la croissance d'une entreprise technologique. Évaluer des opportunités d'affaires, développer des produits adaptés aux besoins des clients, lever des fonds et construire une équipe gagnante. Compétences et outils afin de transformer des idées technologiques en entreprises durables.

**Volet :** Cours magistral

**GNG 4528 Introduction au génie nucléaire (3 crédits)**

Révision de la structure des atomes. Interaction du rayonnement nucléaire avec la matière. Réactions nucléaires. Radioactivité, fission fusion. Combustibles nucléaires. Réacteurs nucléaires et énergie nucléaire. Diffusion et modération des neutrons. Théorie des réacteurs nucléaires. Transfert de chaleur dans les réacteurs nucléaires. Production et distribution d'énergie. Déchets radioactifs. Protection contre la radiation. Approbation, sécurité et environnement. Diverses applications.

**Volet :** Cours magistral

Préalable : 54 crédits universitaires.

**GNG 4570 Droit pour les ingénieurs (3 crédits)**

Caractéristiques fondamentales des lois et de leurs applications en regard des contrats, agences, propriétés, droits sur l'eau, formes diverses des structures d'entreprises, ventes, assurances, services, emplois, régulations gouvernementales des entreprises, moyens de négociation, faillites, brevets d'invention, droits d'auteurs, marques de commerce; responsabilités éthiques, enregistrements professionnels; accent particulier sur les documents contractuels utilisés lors des travaux de construction.

**Volet :** Cours magistral

**GNG 4571 Propriété intellectuelle et droit des technologies pour les ingénieurs (3 crédits)**

Les secrets de fabrication des logiciels et des progiciels, biotechnologie, commerce électronique et autres méthodes de commerce. Préparation et analyse d'une demande de brevet. Analyse d'innovation et de violation de la loi sur la propriété intellectuelle. Protection des brevets partout au monde. Marque de commerce et appellation des sites Internet. Droit d'auteur avec une emphase sur les programmes informatiques et l'Internet. Conception industrielle et la protection des topographies des circuits intégrés.

**Volet :** Cours magistral

**GNG 5120 Technology entrepreneurship for Engineers and Computer Scientists (3 units)**

Hands-on introduction to the many dimensions of starting and growing a technology company. How to evaluate market opportunities, develop a product that customers need, raise capital and build a winning team. Skills and tools to turn technical ideas into profitable sustainable businesses. Students will submit a report describing how their graduate studies work (e.g. Thesis or Project) could be commercialized using the approaches learned in class.

**Course Component:** Lecture

**GNG 5121 Planning of Experiments in Engineering Design (3 units)**

Two-level statistical experimental methods as applied to engineering design; analysis of means, analysis of variance, contrasts, multifactorial analysis of variance, fractional factorial design, screening designs, product variation and an introduction to the Taguchi approach.

**Course Component:** Lecture

**GNG 5122 Operational Excellence and Lean Six Sigma (3 units)**

Lean Six Sigma Green Belt tools and techniques, operational efficiency, waste and variability reduction, continuous improvement, the pursuit of perfection. DMAIC (define, measure, analyze, improve and control), process mapping, data collection and analysis, root cause problem solving, the cost of quality, mistake proofing, change management.

**Course Component:** Lecture

**GNG 5123 Enterprise Architecture (3 units)**

Enterprise architecture as a rigorous planning methodology that harmonizes and integrates the needs of society, management, and engineering in both business and government. Based on an analysis of currently available frameworks and standards, the course will address the design of enterprise business architectures and the derivation of supporting information systems infrastructure.

**Course Component:** Lecture

**GNG 5124 Internet Technologies and Mobile Commerce (3 units)**

An examination of current Internet technologies, protocols and wired and wireless infrastructures. Analysis of current Internet-based businesses and consumer applications and services. Discussion of mobile commerce business models and strategies and their relevant technologies. Hands-on experience with discussed technologies and applications. Students will complete a project demonstrating and analyzing how an Internet-based application or service could be applied in their field of graduate study.

**Course Component:** Lecture

**GNG 5125 Data Science Applications (3 units)**

Analysis and design of various data cleaning, wrangling, blending, and visualization, statistical inference, classification, clustering, regression, and content analysis methods. Use of machine learning algorithms to extract meaningful information from data to make decisions. Formulating analytics problems for business and developing, evaluating, and maintaining machine learning models. Analyzing, generating, and communicating insights on the models. Hands-on experience with an integrated set of current data analytics, data mining, and machine learning tools.

**Course Component:** Lecture

GNG 5125, EBC 5125, CSI 5155, CSI 5387 cannot be combined for units.

**GNG 5130 Business Communication and Influence (3 units)**

Foundations of communication and influence in the business world. The focus will be on professional communication between engineers and customers to determine the requirements and features that can be delivered to meet what customers want, need and can afford. Topics include: eliciting complex needs and developing the cost justifications for their delivery; the main motivations people and organizations have for buying engineering products and services; techniques for questioning, listening and acting in a highly effective manner; removing anxiety from financial discussions of engineering solutions; being able to present, pitch or write compelling proposals for engineering solutions in an effective and consistent manner.

**Course Component:** Lecture

**GNG 5131 Sales and Influence for Engineers (3 units)**

Return on Investment (ROI), commercial proposals, sale management, team compensation, presentations of all types, negotiation and opportunity management. How to perform an assessed buying analysis on an offering both individually and as a team. Hands-on training on how to prepare, execute and progress face-to-face engineering sales calls or customer needs development using their analysis. Engineering proposals and presentations.

**Course Component:** Lecture

Prerequisite: GNG 5130.

**GNG 5140 Engineering Design (3 units)**

Open ended, hands-on engineering design course that provides students with fundamentals and advanced concepts of the engineering design process from client empathy to prototyping and testing. Students work directly with clients to solve a real societal need. There is a strong component of teamwork and lifelong learning.

**Course Component:** Lecture

**GNG 5141 Creativity and Innovation (3 units)**

Factors that enhance individual and group creativity in organizations and its translation into successful technological innovations. Problem identification and idea generation. The invention/innovation process. Creativity techniques and tools. Teamwork, case studies and a project.

**Course Component:** Lecture

GNG 5141 and EMP 5111 cannot be combined for units.

**GNG 5231 Sales Engineer Internship Project (6 units)**

Completion of a project that provides experience as a sales engineer by applying skills, knowledge, techniques, and/or tools to comprehensively elicit, develop and price needs, then communicate technical solutions to a client. Project must be approved by the student's program and the faculty coordinator. It will be mentored by an industry expert and a professor who co-supervise the project. Project will be evaluated by interim report(s) and a final project report submitted to the supervisory professor, as well as by a formal assessment of the result obtained by the industry expert.

**Course Component:** Research

Prerequisite: GNG 5131.

**GNG 5299 Industry Internship Project (6 units)**

Completion of a project that provides industrial experience by applying skills, knowledge, techniques, and/or tools to address a problem for a client. Project must be approved by the student's program and the faculty coordinator. It will be mentored by an industry expert and a professor who co-supervise the project. Project will be evaluated by interim report(s) and a final project report submitted to the supervisory professor, as well as by a formal assessment of the result obtained by the industry expert. International projects (location or industry expert) are permitted.

**Course Component:** Research

**GNG 5300 Topics in Engineering (3 units)**

Recent and advanced topics for students in any engineering or computer science discipline. Topics vary from year to year.

**Course Component:** Lecture

**GNG 5310 Topics in Industry Practice (3 units)**

Recent and advanced topics related to industry practice for students in engineering and computer science. Topics vary from year to year.

**Course Component:** Lecture

**GNG 5520 Entrepreneurial technologique pour ingénieurs et informaticiens (3 crédits)**

Introduction pratique aux multiples dimensions du démarrage et de la croissance d'une entreprise technologique. Évaluer des opportunités d'affaires, développer des produits adaptés aux besoins des clients, lever des fonds et construire une équipe gagnante. Compétences et outils afin de transformer des idées technologiques en entreprises durables. Les étudiants devront soumettre un rapport décrivant comment leurs études supérieures, leur travail (par exemple thèse ou du projet) pourraient être commercialisés en utilisant les méthodes apprises en classe.

**Volet :** Cours magistral

**GNG 5523 L'architecture d'entreprise (3 crédits)**

L'architecture d'entreprise comme méthode de planification rigoureuse qui harmonise et intègre les besoins de la société, de la gestion et de l'ingénierie. À partir d'une analyse des cadres et des normes actuellement disponibles, le cours étudie comment les architectures d'affaires des entreprises et la manière dont l'infrastructure de technologie de l'information est construite afin de répondre aux besoins d'affaires d'une organisation.

**Volet :** Cours magistral

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**GNG 5524 Technologies de l'Internet et de Commerce Mobile (3 crédits)**

Un examen des technologies Internet actuelles, les protocoles et les infrastructures filaires et sans fil. Analyse des entreprises actuelles basées sur Internet, et applications et service grand public. Discussion des modèles d'affaires de commerce mobile et les stratégies et les technologies pertinentes. L'expérience pratique avec technologies et applications discutées. Les étudiants feront un projet démontrant et analysant la façon dont une application ou un service basé sur l'Internet pourraient être appliquées dans leur domaine d'études supérieures.

**Volet :** Cours magistral