

## COURSE INFORMATION

Course Name: Biological Aspects of Wastewater Treatment      Course Code: CIV ENG 4V04 (6V04)

Session Offered: Winter 2021

Calendar Description: 4 units. Microbial kinetics and cell yield in biological wastewater treatment; conventional activated sludge systems; models of activated sludge systems; aeration systems; sedimentation; membrane bioreactors; biological nutrient removal; sequential batch reactors; biosolids treatment, including sludge thickening, anaerobic digestion and dewatering; attached growth reactors, including trickling filters, rotation disk contactors and fluidized bed reactors.

Instructor: Younggy Kim (JHE 334; [younggy@mcmaster.ca](mailto:younggy@mcmaster.ca); no Ave-to-Learn email)

Class Schedule (Location: Virtual):

Lecture: Mo 10:30-11:20am; Th 9:30-11:20am

Office hr: Th 11:30am-12:20pm

Lab: Tu 2:30-5:20pm; Th 11:30am-2:20pm; Th 2:30-5:20pm; Fr 8:30-11:20am

Tutorial: Tu 9:30-11:20am; Fr 11:30am-1:20pm

Lab instructor: Monica Han Han (JHE 201; [hanm7@mcmaster.ca](mailto:hanm7@mcmaster.ca); available by appointment)

Teaching Assistants: Bayshakhi Nath ([debnathb@mcmaster.ca](mailto:debnathb@mcmaster.ca)); Jingyi Chen ([chenj40@mcmaster.ca](mailto:chenj40@mcmaster.ca));

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## 1. COURSE OBJECTIVES

At the end of the course, students will have solid understanding of fundamentals of biological reactions in various wastewater treatment processes. Students will also practice and obtain relevant skills and techniques in evaluating and designing wastewater treatment processes.

## 2. COURSE SPECIFIC POLICIES

**Attendance:** Lecture attendance is expected but will not be reflected in grading. It is strongly recommended that every student should not miss any lectures. Instructor's written notes will not be shared while power point presentations and handouts will be posted on A2L.

**Textbook and course materials:** There are no designated textbooks in this course. In case you are interested in biological wastewater treatment, you can read: Grady et al., Biological wastewater treatment; Metcalf & Eddy, Wastewater engineering; and Rittmann & McCarty, Environmental biotechnology. Course materials will be posted on A2L (not on MS Teams).

**Examinations:** No mid-term exams. The final exam is an open-book and open-source examination. However, exam questions can hardly be answered from the internet. Please attend lectures if you want to do well in the final exam.

**Assignments:** 4 homework assignments will be posted on A2L. Completed assignments must be submitted through A2L (no submission on MS Teams or via emails). Late assignments will be assessed a penalty of 20% per academic day in general; however, late assignments may not be accepted depending on course schedule.

**In-class quiz:** There will be an in-class quiz for each lecture (i.e., 24 quizzes). The due of each quiz is 11:55pm on the date of the lecture. Late submission will not be accepted. The submission link will be inactive at 11:55pm. In-class quiz must be completed on A2L (no submission on MS Teams or via emails). For quiz completion, go to Assessments → Assignments (not Quizzes) on A2L. Quiz questions will be released during each lecture.

**Laboratory experiments:** Each student must participate in all VIRTUAL mandatory laboratory sessions, which will provide supplemental exposure to several important concepts that are covered in this course. We will have four regular lab sessions in addition to a preliminary lab. The tentative dates for lab sessions are available on the

Avenue calendar. Lab experiments will be conducted in groups of four students. All group members must participate in all labs. All group members are expected to take part in report preparation. Expected formats and structure of lab report will be posted on Avenue. A late penalty of 20% per academic day will be applied. All group members must read the lab handout prior to a lab session. There may be pre-lab quizzes to ensure that you have read the lab handouts and understand experimental steps and materials. Both of the lab report and quiz will be included in your term project evaluation. During the preliminary lab session, we will have a safety presentation and group assignment. Attendance at this VIRTUAL preliminary lab is also mandatory.

**Tutorials:** Prerequisite materials, design examples, ASM development, new wastewater treatment technologies will be covered in tutorials. We will also learn to use commercial software tools. We do not have tutorials every week and tutorial dates will be announced on Avenue.

**MSAF Policy:** When a self-reporting relief is submitted, the portion of the missed academic work will be automatically transferred to the final examination. It is your responsibility to notify the instructor of your MSAF submission. For a group assignment (including lab attendance, term project reports), MSAF will NOT be accepted.

**Laboratory Safety: The lab space can be a dangerous place if you do not follow safety rules!**

The Faculty of Engineering is committed to McMaster's University Workplace and Environmental Health and Safety Policy which states: "Students are required by University policy to comply with all University health, safety and environmental programs". It is your responsibility to understand McMaster University Workplace and Environmental Health and Safety programs and policies. For information on these programs and policies please refer to McMaster University Environmental and Health Support Services Occupational Safety Risk Management Manual at (suggested reading: Sections 10 through 16): <http://www.workingatmcmaster.ca/med/document/Lab-Safety-Handbook-1-36.pdf> (You can also find this lab safety handbook on Avenue under the Content tab of this course.)

It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for some of the experiments and the laboratory equipment. McMaster University's workplace health and safety guidance during COVID-19 should always be followed. The details and updates of this guidance can be found at <https://hr.mcmaster.ca/resources/covid19/workplace-health-and-safety-guidance-during-covid-19/>. To ensure laboratory safety this term in accordance with McMaster University policy related to COVID-19, all labs will be held virtually.

It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for some of the experiments and the laboratory equipment.

The safety requirements for JHE 220 are listed below. Students not abiding by these safety requirements will be given one warning. Second offences will result in the student being asked to vacate the laboratory, and receiving a grade of zero for that particular lab.

- Glasses or safety glasses/goggles must be worn in the lab *at all times*.
- Contact lenses are *not* to be worn in the lab.
- No short (i.e., above the knee) pants or skirts are permitted in the lab – lab coats must be worn over top of your clothing in these instances.
- Closed-toe shoes must be worn at all times.
- No loose clothing allowed.
- Long hair must be tied back.
- Gloves must be worn *at all times*.

### 3. SCHEDULE

WEEK 1: Introduction of biological wastewater treatment

WEEK 2: Characterization of wastewater: Suspended solid, oxygen demand, nitrogen and phosphorus

WEEK 3: Kinetics of microbial growth and substrate utilization: Monod equation and its applications

WEEK 4: Estimation of kinetic parameters in biological wastewater treatment:  $Y$ ,  $K_s$ ,  $k$  ( $\mu_m$ ),  $b$

WEEK 5: Conventional activated sludge (CAS)

WEEK 6: Conventional activated sludge design

WEEK 7: Activated Sludge Model #1 (ASM1)

WEEK 8: Gas transfer and aeration system design

WEEK 9: Aeration system design (continued); Settling and thickening  
 WEEK 10: Settling and thickening of wastewater sludge  
 WEEK 11: Nutrient removal; Sequencing batch reactors (SBRs)  
 WEEK 12: membrane bioreactors (MBRs); Attached growth reactors  
 WEEK 13: Anaerobic digestion for wastewater sludge treatment  
 FINAL EXAM: Scheduled during the regular University Final Examination period established by the Registrar's Office

4. ASSESSMENT OF LEARNING	WEIGHT %
Assignment (4 homework assignments)	20% (5% each)
In-class quiz (24 quizzes)	30% (1.5% a 2-hr lecture; 1% a 1-hr lecture)
Term project and report (ASM#1)	10% (5% model; 5% group report)
Lab experiments and reports (4 group lab reports)	16% (4% each)
Final examination	24%

## 5. LEARNING OUTCOMES

### CEAB Learning Indicators Measured in This Course

- 1.1 Competence in Mathematics
- 1.2 Competence in Natural Sciences
- 1.3 Competence in Engineering Fundamentals
- 1.4 Competence in Specialized Engineering knowledge (I, D, A--both)
- 2.2 Demonstrates an ability to identify a range of suitable engineering fundamentals (including mathematical techniques) that would be potentially useful for analyzing a technical problem.
- 2.3 Obtains substantiated conclusions as a result of a problem solution including recognizing the limitations of the solutions.
- 3.2 Selects appropriate model and methods and identifies assumptions and constraints.
- 3.3 Estimates outcomes, uncertainties and determines appropriate data to collect.
- 4.1 Recognizes and follows an engineering design process. (This means an iterative activity that might include recognizing the goal, specifying the constraints and desired outcomes, proposing solutions, evaluating alternatives, deciding on a solution, and implementing.)
- 4.2 Recognizes and follows engineering design principles including appropriate consideration of environmental, social and economic aspects as well as health and safety issues.
- 4.3 Proposes solutions to open-ended problems.
- 4.5 Includes appropriate health and safety considerations
- 5.1 Evaluates and selects appropriate modern tools.
- 5.2 Demonstrates an ability to use modern/state of the art tools.
- 6.3 Works in a group, taking a leadership role as appropriate and relinquishing the leadership role as appropriate. (Lab experiments and report preparation; term project)
- 7.3 Constructs effective oral or written arguments as appropriate to the circumstances (Report preparation)

### Learning Outcomes (Corresponding Graduate Attributes in Parenthesis)

#### 1. Introduction

- Know the two main objectives of wastewater treatment. (1.4)
- Be able to explain how to remove particulate organic compounds. (1.3)
- Be able to explain why we need to remove nutrients in WWT. (1.2)
- Be able to explain how to remove dissolved (and colloidal) organic compounds. (1.3)
- Know the wastewater treatment trains with individual unit processes (1.4)
- Know the sludge (biosolids) treatment trains with individual unit processes. (1.4)

#### 2. Wastewater Analysis

- Know the solids categorization based on size and volatility. (1.4)
- Know the definition of TS, TFS, FFS, VFS, TSS, FSS, and VSS. (1.4)
- Know how to measure TSS and VSS. (1.4)
- Know the meaning of TSS and VSS for the microorganism concentration. (1.4)
- Can calculate ThOD for a given chemical composition. (1.2)
- Know the definition of NOD. (1.4)
- Know the definition of COD and can measure COD for a water sample. (1.4)
- Know the definition of BOD and can measure BOD for a water sample. (1.4)

- Plot “measured BOD vs. time” with and without nitrification. (1.4)
  - Know how to find  $BOD_L$  from measured  $BOD_5$ . (1.4)
  - Know the definition of TOC. (1.4)
  - Know the nitrogen compounds in wastewater. (1.4)
  - Know the phosphorus compounds in wastewater. (1.4)
- 3. Microbial kinetics**
- Know the definition of catabolism, anabolism, and metabolism. (1.2)
  - Know the definition of microbial yield coefficient. (1.4)
  - Can correlate  $dS/dt$  and  $dX/dt$  using  $Y$ . (1.4)
  - Know the rate expression for microbial growth. (1.4)
  - Know the Monod equation and can plot  $\mu$  as a function of  $S$ . (1.4)
  - Know the rate expression for substrate utilization. (1.4)
  - Know the rate expression for microbial decay and net growth rate. (1.4)
  - Know the five kinetic parameters:  $Y$ ,  $K_s$ ,  $k$  ( $\mu_m/Y$ ), and  $b$ . (1.4)
  - Know the definition of specific substrate utilization,  $U$ . (1.4)
  - Know the definition of food-to-microorganism ratio,  $F/M$  ratio. (1.4)
- 4. Conventional Activated Sludge Process**
- Know the difference between chemostat and activated sludge systems. (3.2)
  - Be able to draw the activate sludge process and know the assumptions. (3.2)
  - Know the definition of solids retention time both in verbal and mathematical expressions (1.4)
  - Be able to perform mass balance on  $X$  across the entire system and derive the  $S$  expression. (1.1; 1.4)
  - Be able to perform mass balance on  $S$  across the entire system and derive the  $X$  expression. (1.1; 1.4)
  - Know that  $1/\theta_c$  is equivalent to the net cell growth rate (1.4)
  - Know the physical meaning of  $\theta_c$  (1.4)
  - Know the following correlations between  $\theta_c$  and microbial composition in AS (1.2; 1.4)
    - Short  $\theta_c$ : we will have only fast-growing microorganisms in AS.
    - Long  $\theta_c$ : we will have both fast- and slow-growing microorganisms in AS.
    - Nitrifying bacteria are slow-growing microorganisms; thus, nitrification will occur for long  $\theta_c$ .
  - Can do mass balance on  $X$  across clarifier to find the expression for  $Q_r/Q$  (1.3; 1.4)
  - Can find the equation for waste sludge production:  $Q_w X_r$  (1.4)
  - Can find minimum solids retention time ( $\theta_c^m$ ) by assuming washout (1.4)
  - Know the combine sewer and separate sewer systems (1.4)
  - Know how  $\theta_c$  controls the following AS operation factors. (1.4)
    - $\theta_c \uparrow \rightarrow S \downarrow$  (if  $\theta_c > 5d$ ,  $S$  is already sufficiently small and thus rather independent on  $\theta_c$ )
    - $\theta_c \uparrow \rightarrow$  amount of waste sludge  $\downarrow$  (by which eqn?)  $\rightarrow$  \$  $\downarrow$  for sludge (biosolids) management
    - $\theta_c \uparrow \rightarrow X \uparrow$  (by which eqn?)  $\rightarrow$   $O_2$  requirement  $\uparrow \rightarrow$  \$  $\uparrow$  for aeration
    - $\theta_c \uparrow \rightarrow X \uparrow \rightarrow Q_r \uparrow$  (by which eqn?)  $\rightarrow$  \$  $\uparrow$  for RAS pumping
    - $\theta_c \uparrow \rightarrow$  activation of nitrifying bacteria  $\rightarrow$   $NH_3$  removal  $\uparrow$
    - $\theta_c \uparrow \rightarrow$  “may” cause sludge bulking problem
  - Can explain the following operation factors and their effects. (1.4)
    - $S_0 \uparrow \rightarrow X \uparrow$  (by which eqn?)
    - $X_r \uparrow$  (better clarifier)  $\rightarrow Q_r \downarrow$  (by which eqn?)
    - $V \uparrow \rightarrow X \downarrow$  (by which eqn?)  $\rightarrow Q_r \downarrow$  (by which eqn?)
  - Be able to design an activated sludge system (4.1)
  - Know the major capital and operation costs for wastewater treatment (4.2)
  - Able to do mass balance on  $X_i$  (inert solids) to find  $X_i$  concentration in aeration tank (1.4)
- 5. Estimation of Microbial Kinetics**
- Can use the equation for  $1/U$  to find  $K_s$  and  $k$  (3.3)
  - Can use the equation for for  $1/\theta_c$  to find  $Y$  and  $b$  (3.3)
  - Can use the Arrhenius equation for temperature correction of kinetic coefficients. (1.2)
  - Know the model for multiple substrates and inhibitors (1.4; 3.2)
  - Know the two types of microorganisms in WWT: heterotrophs and autotrophs (1.2)
  - Know how heterotrophs grow under aerobic and anoxic conditions (1.2; 1.4)

- Know how autotrophs grow under aerobic conditions (1.2; 1.4)
- Know the effect of pH on microbial growth and can include the effect in the model equation (1.4; 3.2)

### **6. Activated Sludge Model No. 1**

- Know the 10 components in Activated Sludge Model No. 1 (1.4)
- Be able to explain hydrolysis of particulate substances (1.4)
- Be able to explain ammonification of soluble organic nitrogen compounds (1.2; 1.4)
- Know two mechanisms of ammonia consumption in activated sludge processes (1.2; 1.4)
- Know the distribution of decayed cell materials. (1.4)
- Be able to sketch the reaction charts in ASM1 (1.4)
- Be able to write a mass balance equation on each component (1.3)
- Be able to solve the 10 mass balance equation using a numerical method (Term Project) (1.1)
- Can use ASM No.1 to better understand how CAS works (Term Project) (5.2)
- Know the benefits and limitations of ASM No.1 (2.3; 3.3; 5.1)
- Attempt to expand ASM No.1 for an emerging contaminant (Term Project) (4.3)
- Can use commercial software (e.g., BioWin) (5.2)

### **7. Aeration systems in activated sludge**

- Be able to calculate the oxygen requirement for BOD removal and nitrification (1.4)
- Know Henry's law (1.2)
- Know the kinetics of gas transfer (1.2)
- Can correct the kinetic and equilibrium constants for temperature, surfactant, and activity coefficient (1.4)
- Can design an aeration system by finding actual  $O_2$  transfer rate (4.1)

### **8. Sedimentation tanks**

- Know the four types of settling (1.4)
- Can plot the  $G_b$  curve vs. particle concentration from settling column tests (4.1)
- Can use the graphical method to find the limiting solids flux (4.1; 5.2)
- Can determine the clarifier size based on the found limiting flux (4.1)
- Know the state point and its physical meaning (1.4)
- Know factors to be considered in designing secondary clarifiers (4.1)
- Know the design trade-off among clarifier, aeration tank and return sludge pump (2.2; 4.2)
- Know sludge volume index (1.4)
- Know the definition of sludge bulking
- Know what cause sludge bulking and how to control it (1.4; 4.2)
- Know the definition of rising sludge and how to control it (1.4)

### **9. Nutrient removal in wastewater treatment**

- Know that nutrient is removed as WAS (1.4)
- Can explain nitrification (1.2; 1.4)
- Can explain denitrification (1.2; 1.4)
- Know the three types of reactor conditions and resulting redox reactions (1.2; 1.3; 1.4)
- Know how phosphorus accumulating organisms (PAOs) remove phosphorus (1.2; 1.4)
- Know various BNR processes (1.4; 5.1)
- Know the benefits and limitations of the individual BNR processes (1.4; 5.1)
- Know the fate of excessively uptaken P in later sludge treatment processes (4.3)
- Know the chemical phosphorus removal method (1.2; 1.4)

### **10. Sequencing batch reactors (SBRs)**

- Know the operation steps of SBRs (1.4)
- Can analyze SBR performance by doing mass balance during the React step (1.1; 1.4; 3.2)
- Know the benefits of SBRs compared to continuous flow systems (4.2)

### **11. Membrane bioreactors (MBRs)**

- Know the advantages and disadvantages of MBRs compared to CAS (1.4; 4.2)
- Two types of MBRs: External side-stream MBRs; Submerged MBRs (1.4; 4.2)

### **12. Attached growth reactors**

- Know the four types of attached growth reactors (1.4)
- Know the advantages and disadvantages of attached growth systems (1.4)

- Know three distinct regions in the biofilm system (1.4)
- Can drive the micro-scale mass balance equation and set up the boundary conditions (1.1; 1.3)
- Know the equation for mass flux in the liquid film. (1.4)
- Know the definition of the shallow and deep biofilms. (1.4)
- Know the kinetic expression for S removal in biofilm depending on the rate-limiting component. (1.4)
- Can set up the macro-scale mass balance equation depending on the type of attached growth reactors (3.2)
- Can find the effluent quality from a numerical grid by equating the micro- and macro-scale mass balance equations (1.1)

### 13. Anaerobic Digestion

- Know the objective of anaerobic digestion (1.4)
- Know the four macro nutrients and their monomers (1.2)
- Be able to sketch the anaerobic reaction chart (1.4)
- Can explain hydrotropic methanogenesis (1.2; 1.4)
- Can explain acetoclastic methanogenesis (1.2; 1.4)
- Can explain anaerobic oxidation ( $\beta$ -oxidation) (1.2; 1.4)
- Can explain fermentation (1.2; 1.4)
- Can explain hydrolysis (1.2; 1.4)
- Be able to find out the rate-limiting reaction from multiple chain reactions. (1.4)
- Know the effect of pH on anaerobic digestion (1.4)
- Know the effect of temperature on anaerobic digestion (1.4)
- Know the consequences of having sulfate in wastewater (1.3; 1.4)
- Know the role of ammonia ( $\text{NH}_3$ ) in pH buffering and toxic effects (1.2; 1.4)
- Know the two (three) types of reactors (1.4; 4.2)
- Know the benefits of anaerobic digestion (1.4)
- Can find the rate of  $\text{CH}_4$  production (1.4)
- Know the design factors of anaerobic digesters (4.2)
- Know the important operation and monitoring factors (1.4)

## 6. COMMUNICATIONS

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their "@mcmaster.ca" alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

## 7. POLICIES

### ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the [Academic Integrity Policy](https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/), located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>.

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.

- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

### **AUTHENTICITY / PLAGIARISM DETECTION**

**Some courses may** use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity).

### **COURSES WITH AN ON-LINE ELEMENT**

**Some courses may** use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

### **ONLINE PROCTORING**

**Some courses may** use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

### **CONDUCT EXPECTATIONS**

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online.**

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

### **ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES**

Students with disabilities who require academic accommodation must contact [Student Accessibility Services \(SAS\)](#) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University's [Academic Accommodation of Students with Disabilities](#) policy.

### **REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK**

[McMaster Student Absence Form \(MSAF\)](#): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

The McMaster Student Absence Form is a self-reporting tool for **Undergraduate Students** to report absences that last up to 5 days and provides the ability to request accommodation for any missed academic work. Please

note, this tool cannot be used during any final examination period. You may submit a maximum of 1 Academic Work Missed requests per term. It is **your** responsibility to follow up with your Instructor immediately regarding the nature of the accommodation. If you are absent more than 5 days or exceed 1 request per term you **must** visit your Associate Dean's Office (Faculty Office). You may be required to provide supporting documentation. This form should be filled out immediately when you are about to return to class after your absence.

### **ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

### **COPYRIGHT AND RECORDING**

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

### **PROTECTION OF PRIVACY ACT (FIPPA)**

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades, and all other personal information at all times. For example, the submission and return of assignments and the posting of grades must be done in a manner that ensures confidentiality – see <http://www.mcmaster.ca/univsec/fippa/fippa.cfm>.

### **ANTI-DISCRIMINATION**

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer, or the Human Rights Consultant, as soon as possible.

[https://www.mcmaster.ca/policy/General/HR/Discrimination\\_and\\_Harassment.pdf](https://www.mcmaster.ca/policy/General/HR/Discrimination_and_Harassment.pdf)

### **EXTREME CIRCUMSTANCES**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

## **8. MCMASTER GRADING SCALE**

<b>Grade</b>	<b>Equivalent Grade Point</b>	<b>Equivalent Percentages</b>
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76
B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62
D+	3	57-59
D	2	53-56
D-	1	50-52
F	0	0-49