

Course Outline

1. COURSE INFORMATION

Session Offered	Fall 2023	
Course Name	Industrial Biotechnology	
Course Code	BIOTECH 3B03	
Date(s) and Time(s) of lectures	Tuesday 2:30-3:20 Thursday 2:30-4:20	
Program Name	Biotechnology	
Calendar Description	A continuation of Biotechnology concepts including a more in-depth application of the recombinant technology and gene expression systems. Applications include microbial, plant, and animal biotechnology, bioremediation, cloning and stem cell technology.	
Instructor(s)	Dr. Faiez Alani (Lecture)	E-Mail: alanif@mcmaster.ca Office Hours & Location: ETB 205 Tuesday 1:30-2:30 pm Or by appointment
	Nazia Pathan (Lab)	E-mail: pathann@mcmaster.ca Office Hours & Location: By appointment only

2. COURSE SPECIFICS

Course Description	The course will cover topics in biotechnology such as bioprocess and fermentation technology, application of molecular biology concepts in genome management with application in industry such as strain development and genetic engineering of prokaryotic and eukaryotic cells. The enzyme biotechnology and the different techniques used such as immobilized enzymes and bed-backed bioreactors. Application of biotechnology in medicine; bioenergy and food industries.		
Instruction Type	Code	Type	Hours per term
	C	Classroom instruction	38
	L	Laboratory, workshop or fieldwork	36
	T	Tutorial	n/a
	DE	Distance education	n/a
	Total Hours		74
Resources	ISBN	Textbook Title & Edition	Author & Publisher
	ISBN: 9780511802751	Biotechnology, 5th edition	John E. Smith, Cambridge
	Other Supplies	Source	
	Avenue to learn	http://avenue.mcmaster.ca	
Prerequisite(s)	BIOTECH 2B03, 2GT3, 2MB3		
Corequisite(s)	n/a		
Antirequisite(s)	n/a		
Course Specific Policies	The attendance of lectures is strongly encouraged and there are many quizzes and participation marks. Students should attend all laboratory sessions and submit lab report. Absence from lab with no well documented excuse or failure to submit the		

	<p>report in time result with F grade in that lab. It is the responsibility of the student to download Lab. procedures from lab manual on-line (Avenue to learn). There is no make-up policy in the term tests and quizzes for this course. If the student missed any midterm then the percentage of the final will be increased to compensate the missing midterms if the student has well documented and approved report for the absence (See MSAF information below). Students must pass both components of the course – labs and lectures - to pass the course. Students should be aware that, when they access the electronic components of this course, 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 this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor. The instructor may also use other software including: e-mail, Avenue, LearnLink, web pages, capa, Moodle, Thinking Cap, etc. The communications via email is strictly by Official McMaster University Account, no reply to the commercial emails and/or nick names. Late submissions of assignments and Lab report will be penalized 10% per day within one week.</p>	
<p>Departmental Policies</p>	<p>Students must maintain a GPA of 3.5/12 to continue in the program.</p> <p>In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of “out-of-class” work for every scheduled hour in class. “Out-of-class” work includes reading, research, assignments and preparation for tests and examinations.</p> <p>Where group work is indicated in the course outline, such collaborative work is mandatory.</p> <p>The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception.</p> <p>Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class.</p> <p>Instructor has the right to submit work to software to identify plagiarism.</p>	
<p>3. SUB TOPIC(S)</p>		
<p>Week 1</p>	<p>Nature of biotechnology and development</p>	<p>Ch1</p>
<p>Week 2</p>	<p>Biomass: a biotechnology substrate: Natural raw materials, raw materials, and the future of biotechnology Quiz 1, Case study 1</p>	<p>Ch2</p>
<p>Week 3</p>	<p>Genome management: Genetic manipulation, Industrial genetics Quiz 2, Case study2</p>	<p>Ch3</p>
<p>Week 4</p>	<p>Genome management: strain development and Genetic engineering Quiz 3, Case study 3</p>	<p>Ch3</p>

Week 5	Bioprocess: Principles of microbial growth, media design, solid – substrate fermentation, and mammalian cell culture technology. Quiz 4, Case study 4 Project presentation	Ch4
Mid-term recess Monday, October 9 to Sunday, October 15		
Week 6	Enzyme Technology: The nature of enzymes, production of enzymes and application. Quiz 5 Case study 5 Project presentation	Ch 5
Week 7	Biofuel and Bioenergy: Bioethanol from biomass, biodiesel, methane, and hydrogen. Quiz 6, Case study 6 Project presentation	Ch 6
Week 8	Environmental Biotechnology: Waste treatment, bioremediation, Environmental sustainability, and clean technology. Term Test Project presentation	Ch 7
Week 9	Food Biotechnology: Probiotics and functional food Sweeteners, organic acids, and polysaccharides. Quiz 7, Case study 7 Project presentation	Ch 10
Week 10	Medical biotechnology: Antibiotics, vaccines and monoclonal antibodies, biopharmaceuticals Quiz 8, Case study 8 Project presentation	Ch 11
Week 11	Medical biotechnology: therapeutic proteins, gene therapy. Quiz 9, Case study 9 Project presentation Project final Report due	Ch 11
Week 12	Stem cell biotechnology: The nature of stem cells and cultivation, commercial potential for stem cell therapies. Quiz 10, Case study 10 Project presentation	Ch 12
Week 13	Review	
Classes end: Wednesday, December 6 Final examination period: Friday, December 8 to Thursday, December 21 All examinations MUST be written during the scheduled examination period		
List of experiments		
Lab 1	Introduction	
Lab 2	Real Time PCR (qPCR)	
Lab 3	Transformation and purification of green fluorescent protein	
Lab 4	Blue/white cloning and β -galactosidase assay	
Lab 5	Cloning and Sequencing of GAPDH Part 1: Extraction of Genomic DNA	

Lab 6	Cloning and Sequencing of GAPDH Part 2A: Amplification with nested PCR
Lab 7	Cloning and Sequencing of GAPDH Part 2B: Amplification with nested PCR
Lab 8	Cloning and Sequencing of GAPDH Part 3: Purification and Ligation
Lab 9	Cloning and Sequencing of GAPDH Part 4: Transformation
Lab 10	Cloning and Sequencing of GAPDH Part 5: Plasmid purification (Miniprep)
Lab 11	Animal cell culture transfection
Lab 12	Tour sequencing Lab (MOBIX)

Note that this structure represents a plan and is subject to adjustment term by term. The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.

4. ASSESSMENT OF LEARNING *including dates*	Weight
Case studies & Quizzes	20
Mid-term test	15
Project	10
Participation	05
Labs	25
Final examination (tests cumulative knowledge)	25
TOTAL	100%

Percentage grades will be converted to letter grades and grade points per the University calendar.

5. LEARNING OUTCOMES

1. Apply the molecular biology and biotechnology concepts to genome management in industry, environment, forensics, medicine, and diagnosis.
2. Explain the concept of sustainable energy and its application for the biofuel and in biorefinery especially in bioethanol and biodiesel.
3. Demonstrate enzymes concepts and kinetics in free and immobilized form in food, pharmaceutical, leather, pulp/paper and detergent industries.
4. Identify the different types of stem cells and their clinical application
5. Design bioprocess and apply biotechnology concepts to bioindustry and medicine

6. COURSE OUTLINE – APPROVED ADVISORY STATEMENTS

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.

http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf

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, located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>

The following illustrates only three forms of academic dishonesty: 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.

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.

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.

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 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”.

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. <http://www.mcmaster.ca/policy/Students-AcademicStudies/Studentcode.pdf>

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.

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.