## 1. COURSE INFORMATION

<table>
<thead>
<tr>
<th>Session Offered</th>
<th>Fall 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Name</td>
<td>Industrial Biotechnology</td>
</tr>
<tr>
<td>Course Code</td>
<td>BIOTECH 3B03</td>
</tr>
<tr>
<td>Date(s) and Time(s) of lectures</td>
<td>Monday 11:30-12:30, Thursday 10:30-12:30</td>
</tr>
<tr>
<td>Program Name</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>Calendar Description</td>
<td>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.</td>
</tr>
</tbody>
</table>
| Instructor(s)   | Dr. Faiez Alani (Lecture) E-Mail: alanif@mcmaster.ca Office Hours & Location: Monday 1:30-2:30 pm, Tuesday 1:30-2:30 pm or by appointment, ETB 121A  
Nazia Pathan (Lab) E-Mail: pathann@mcmaster.ca Office Hours & Location: Wednesday 11:30 am -2:30 pm, ETB 209 or by appointment |

## 2. COURSE SPECIFICS

<table>
<thead>
<tr>
<th>Instruction Type</th>
<th>Code</th>
<th>Type</th>
<th>Hours per term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom instruction</td>
<td>C</td>
<td>Classroom instruction</td>
<td>38</td>
</tr>
<tr>
<td>Laboratory</td>
<td>L</td>
<td>Laboratory</td>
<td>30</td>
</tr>
<tr>
<td>Tutorial</td>
<td>T</td>
<td>Tutorial</td>
<td>n/a</td>
</tr>
<tr>
<td>Distance education</td>
<td>DE</td>
<td>Distance education</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td></td>
<td></td>
<td><strong>68</strong></td>
</tr>
</tbody>
</table>

### Resources

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Textbook Title &amp; Edition</th>
<th>Author &amp; Publisher</th>
</tr>
</thead>
</table>

**Other Supplies**

- avenue to learn Labster simulation [http://avenue.mcmaster.ca](http://avenue.mcmaster.ca) [www.labster.com](http://www.labster.com)

**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 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.

Departmental Policies

- Students must maintain a GPA of 3.5/12 to continue in the program.
- 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.
- Where group work is indicated in the course outline, such collaborative work is mandatory.
- 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.
- 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.
- Instructor has the right to submit work to software to identify plagiarism.

3. SUB TOPIC(S)

<table>
<thead>
<tr>
<th>Week</th>
<th>Nature of biotechnology and development</th>
<th>Ch1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 2</td>
<td>Biomass: a biotechnology substrate: Natural raw materials, raw materials and the future of biotechnology</td>
<td>Ch2</td>
</tr>
<tr>
<td></td>
<td><strong>Quiz 1</strong></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td>Genome management: Genetic manipulation, Industrial genetics</td>
<td>Ch3</td>
</tr>
<tr>
<td></td>
<td><strong>Case study1</strong></td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td>Genome management: strain development and Genetic engineering</td>
<td>Ch3</td>
</tr>
<tr>
<td></td>
<td><strong>Quiz 2</strong></td>
<td></td>
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<tr>
<td>Week 5</td>
<td>Bioprocess: Principles of microbial growth, media design, solid –substrate fermentation, and mammalian cell culture technology.</td>
<td>Ch4</td>
</tr>
<tr>
<td></td>
<td><strong>Case study 2</strong></td>
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</table>
Mid-term Recess: Monday, October 9 to Sunday, October 15, 2017

| Week 7 | Enzyme Technology: The nature of enzymes, production of enzymes and application.  
|        | Quiz 3  
|        | Project presentation  
|        | Ch5 |
| Week 8 | Biofuel and Bioenergy: Bioethanol from biomass, biodiesel, methane, and hydrogen.  
|        | Case study 3  
|        | Project presentation  
|        | Ch6 |
| Week 9 | Environmental Biotechnology: Waste treatment, bioremediation, Environmental sustainability and clean technology.  
|        | Term Test  
|        | Project presentation  
|        | Ch7 |
| Week 10 | Food Biotechnology: Probiotics and functional food Sweeteners, organic acids and polysaccharides.  
|        | Quiz 4  
|        | Project presentation  
|        | Ch10 |
| Week 11 | Medical biotechnology: Antibiotics, vaccines and monoclonal antibodies, biopharmaceuticals  
|        | Case study 4  
|        | Project presentation  
|        | Ch11 |
| Week 12 | Medical biotechnology: therapeutic proteins, gene therapy.  
|        | Project presentation  
|        | Quiz 5  
|        | Project final Report due  
|        | Ch11 |
| Week 13 | Stem cell biotechnology: The nature of stem cells and cultivation, commercial potential for stem cell therapies.  
|        | Case study 5  
|        | Review  
|        | Ch12 |

Classes end: Wednesday, December 6, 2017  
Final examination period: Friday, December 8 to Thursday, December 21, 2017  
All examinations MUST be written during the scheduled examination period.

List of experiments

| Lab 1 | Introduction and Biosafety |
| 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*

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case studies &amp; Quizzes</td>
<td>10</td>
</tr>
<tr>
<td>Mid-term test</td>
<td>15</td>
</tr>
<tr>
<td>Team Project</td>
<td>15</td>
</tr>
<tr>
<td>Participation</td>
<td>05</td>
</tr>
<tr>
<td>Labs</td>
<td>25</td>
</tr>
<tr>
<td>Final examination (tests cumulative knowledge)</td>
<td>30</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

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. POLICIES

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.


Academic Integrity

You are required to exhibit honestly and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act 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.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, located at:

http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf

The following illustrates only three forms of academic dishonesty:
1. Plagiarism. E.g. the submission of work that is not own or for which other credit has been obtained
2. Improper collaboration in group work
3. Copying or using unauthorized aids in tests and examinations.

Requests for Relief for Missed Academic Term Work (Assignments, Mid-Terms, etc.)

The McMaster Student Absence Form is an on-line self-reporting tool for Undergraduate Students to report absences for:

1) Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:
   - Students may submit a maximum of one academic work missed request per term. It is the responsibility of the student to follow up with instructors immediately (within the 3 day period
that is specified in the MSAF) regarding the nature of the accommodation. All work due in that
time period however can be covered by one MSAF.

- MSAF cannot be used to meet religious obligation or celebration of an important religious holiday,
  for that has already been completed or attempted or to apply for relief for any final examination
  or its equivalent.

2) For medical or personal situations lasting more than three calendar days, and/or for missed
academic work worth 25% or more of the final grade, and/or for any request for relief in a term
where the MSAF has not been used previously in that term:

- Students must visit their Associate Dean’s Office (Faculty Office) and provide supporting
documentation.

E-Learning Policy
Consistent with the Bachelor of Technology’s policy to utilize e-learning as a complement to traditional
classroom instruction, students are expected to obtain appropriate passwords and accounts to access
Avenue To Learn for this course. Materials will be posted by class for student download. It is expected
that students will avail themselves of these materials prior to class. 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 account, and program affiliation may become apparent to all other
students in the 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 this
disclosure please discuss this with the course instructor. Avenue can be accessed via
http://avenue.mcmaster.ca.

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.

Turnitin (Optional)
This course will be using a web-based service (Turnitin.com) to reveal plagiarism. Students submit their
assignment/work electronically to Turnitin.com where it is checked against the internet, published works and
Turnitin’s database for similar or identical work. If Turnitin finds similar or identical work that has not been
properly cited, a report is sent to the instructor showing the student’s work and the original source. The
instructor reviews what Turnitin has found and then determines if he/she thinks there is a problem with the
work. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the
instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All
submitted work is subject to normal verification that standards of academic integrity have been upheld
(e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to
http://www.mcmaster.ca/academicintegrity/turnitin/students/

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 posting of grades must be done in a
manner that ensures confidentiality.
http://www.mcmaster.ca/univsec/fippa/fippa.cfm

Academic Accommodation of Students with Disabilities Policy
Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information consult McMaster’s policy for Academic Accommodation of Students with Disabilities

Students must forward a copy of the SAS accommodation to the instructor of each course and to the Program Administrator of the B.Tech. Program immediately upon receipt. If a student with a disability chooses NOT to take advantage of a SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. http://sas.mcmaster.ca

**Student Code of Conduct**

The Student Code of Conduct (SCC) exists to promote the safety and security of all the students in the McMaster community and to encourage respect for others, their property and the laws of the land. McMaster University is a community which values mutual respect for the rights, responsibilities, dignity and well-being of others. The purpose of the Student Code of Conduct is to outline accepted standards of behavior that are harmonious with the goals and the well-being of the University community, and to define the procedures to be followed when students fail to meet the accepted standards of behavior. All students have the responsibility to familiarize themselves with the University regulations and the conduct expected of them while studying at McMaster University.