

Course Outline

1. COURSE INFORMATION

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| Session Offered | Fall 2015 | |
| Course Name | Chemical Engineering Concepts | |
| Course Code | BIO TECH 2EC3 | |
| Date(s) and Time(s) of lectures | Wed. 8:30-10:20 A.N. Bourns Bldg (ABB) 165 Thurs. 12:30-13:20 Information Technology Bldg (ITB) 139 | |
| Program Name | Biotechnology | |
| Calendar Description | Material balances: single and multi-unit systems with possible reactions. Energy balance: energy conservation including enthalpy calculations, steam tables, specific heats, phase changes, and reactions. Survey of momentum, heat and mass transfer; basics of chemical process design. | |
| Instructor(s) | Dr. Amin R. Rajabzadeh rajaba@mcmaster.ca | E-Mail: Office Hours & Location: Mondays 11:00-13:00 ETB/203 |

2. COURSE SPECIFICS

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| Course Description | Survey of basic engineering process variables and units. Drawing and labeling flowcharts. Balancing mass on single and multi-unit processes without and with reactions. Chemical reaction stoichiometry and its application on material balances. First law of thermodynamics. Mechanical energy balance. Energy balance on open and close systems. Use of thermodynamic tables. Application of energy balances on chemical and biological processes with possible phase change and reaction. Calculation and application of heats of reactions and combustion. | | |
| Instruction Type | Code | Type | Hours per term |
| | C | Classroom instruction | 37 |
| | L | Laboratory, workshop or fieldwork | 12 |
| | T | Tutorial | |
| | DE | Distance education | |
| | Total Hours | | 49 |
| Resources | ISBN | Textbook Title & Edition | Author & Publisher |
| | ISBN: 0-417-68757-X | Elementary Principles of Chemical Processes | R.M. Felder and R.W. Rousseau, John Wiley and Sons, 3 rd (or 4 th) Edition |
| | Other Supplies | Source | |
| | | McMaster Bookstore | |
| Prerequisite(s) | ENG TECH 1CH3, 1MT3, 1PH3 | | |
| Corequisite(s) | None | | |
| Antirequisite(s) | None | | |
| Course Specific Policies | Lab Sessions: <ul style="list-style-type: none"> • Lab coat and safety glasses are required. No open-toe shoes will be allowed. • All notes should be taken on a lab book. • Labs will be conducted on rotational basis. The lab schedule will be | | |

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| | <p>posted on Avenue to Learn.</p> <ul style="list-style-type: none"> • Students must attend all labs, perform all experiments and support a lab report for each experiment. • Absence from a lab without prior permission or a suitable and acceptable explanation will result in a grade of zero for that lab. • Students may have to complete a pre-lab report prior to attending certain labs. • Lab reports are due the following lab session. • Reports submitted late without an acceptable explanation or prior permission will be penalized by 5% per school day. • Students must pass both components of the course, labs and lectures, to pass the course. | |
| Departmental Policies | <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> | |
| 3. SUB TOPIC(S) | | |
| Week 1 | Engineering Calculations Processes and Process Variables | Chapters 2 and 3 |
| Week 2 | Material Balances: -Process Classification, Balances on Single Unit Processes | Sections 4.1 -4.2 |
| Week 3 | Material Balances: - Flowcharts, Scaling, Balancing, Degree- of- Freedom Analysis | Section 4.3 |
| Week 4 | Material Balances: -Multi-Unit Processes | Section 4.4 |
| Week 5 | Material Balances: - Chemical Reaction Stoichiometry | Section 4.6 |
| <i>Mid-term recess (Monday, October 12 to Saturday, October 17)</i> | | |
| Week 6 | Material Balances: - Reactive Processes | Section 4.7 |
| Week 7 | Material Balances: - Combustion Reactions Energy and Energy Balances: -Thermodynamics, Kinetic and Potential Energy | Section 4.8 Sections 7.1-7.2 |
| Week 8 | Energy and Energy Balances: - Energy Balances on Closed and Open Systems, Tables of Thermodynamic Data | Sections 7.3-7.6 |
| Week 9 | Energy Balances on Nonreactive Processes: -Elements of Energy Balance Calculations, Changes in | Sections 8.1-8.3 |

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| | Pressure at Constant Temperature, Changes in Temperature | |
| Week 10 | Energy Balances on Nonreactive Processes : -Phase Change Operations | Sections 8.4a-c |
| Week 11 | Energy Balances on Reactive Processes: -Heats of Reaction, Calculation of Heats of Reaction | Sections 9.1-9.2 |
| Week 12 | Energy Balances on Reactive Processes: -Formation Reactions and Heats of Formation, Heats of Combustion | Sections 9.3-9.4 |
| Week 13 | Review | |
| <p>Classes end – Tuesday December 8, 2015 Final examination period: Wednesday December, 9, 2015 to Tuesday, December 22, 2015 All examinations MUST BE written during the scheduled examination period.</p> | | |
| List of experiments | | |
| Lab 1 | Distillation | |
| Lab 2 | Heat Exchanger | |
| Lab 3 | Evaporator | |
| Lab 4 | Continuously Stirred Tank Reactors (CSTRs) | |
| Lab 5 | Neutralization | |
| Lab 6 | Membrane Filtration | |
| Lab Schedule | Some of the labs will be performed on a rotating basis. The actual lab schedule will be provided by the instructor. | |
| <i>Mid-term recess (Monday, October 12 to Saturday, October 17)</i> | | |
| <p>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.</p> | | |
| 4. ASSESSMENT OF LEARNING *including dates* | | Weight |
| Assignments | | 15 |
| Term Test 1 (Week 5, to be confirmed) | | 15 |
| Term Test 2 (Week 10, to be confirmed) | | 15 |
| Labs | | 20 |
| Final examination (tests cumulative knowledge) | | 35 |
| TOTAL | | 100% |
| Percentage grades will be converted to letter grades and grade points per the University calendar. | | |
| 5. LEARNING OUTCOMES | | |
| 1. Given a process description a) draw and label a flowchart; b) choose a basis of calculation; c) perform the degree-of-freedom analysis; d) write in order, the equations needed to calculate specified process variables; and e) perform the calculations. This applies to both single and multiple unit processes. | | |
| 2. For systems involving reactions, must be able to use: molecular species balances, atomic species balances, or extents of reaction to perform the degree-of-freedom analysis and the process material balance calculations. | | |
| 3. Given a description of a closed process system: apply the first law of thermodynamics, simplify the energy balance and solve it for specified process variables. | | |
| 4. Given a description of an open process system: write the energy balance in terms of enthalpy and shaft work, simplify the energy balance and solve it for specified process variables. | | |
| 5. Learn how to use steam tables and other physical property tables (in Appendix B) | | |

- Evaluate changes in specific enthalpies and internal energies when this data is not available in tables for all process species. Once these calculations are performed, write energy balances and solve to determine the energy requirements for nonreactive processes.
- Write and solve energy balances on a reactive system using either the heat of reaction method (taking reactant and product species as references for enthalpy calculations) or the heat of formation method (taking elemental species as references).

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.

<http://www.mcmaster.ca/policy/General/HR/Anti-Discrimination%20policy.pdf>

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 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.

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:

- Plagiarism. E.g. the submission of work that is not own or for which other credit has been obtained
- Improper collaboration in group work
- 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 a self-reporting tool for **Undergraduate Students** to report absences that last up to 3 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 3 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.

<http://www.mcmaster.ca/msaf/>

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

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. <http://judicialaffairs.mcmaster.ca/pdf/SCC.pdf>