Course Outline
PROC 7021

Spring 2020-2021

MEMORIAL
U N I V E R S I T Y

Faculty of Engineering and Applied Science

PROC 7021: Process Dynamics and Control

Instructor	Dr. Salim Ahmed
E-mail	sahmed@mun.ca, Brightspace (D2L) email is preferred
Phone	864-7652 (w)
Office Location	IIC-3026
Office Hours	Wed 12:00-1:00
Teaching Assistant	Pulok Deb
Email	pkd675@mun.ca
Website	Brightspace page on online.mun.ca

Communication   *The Brightspace (D2L) system will be the medium of communication between the instructor and students. Important updates on the course will be posted on the course page.* **It is the responsibility of the students to regularly check for course related information on the course page**.

INCLUSION AND EQUITY:

Students who require accommodations are encouraged to contact the Glenn Roy Blundon Centre, https://www.mun.ca/student/accessibility/. The mission of the Blundon Centre is to provide and co-ordinate programs and services that enable students with disabilities to maximize their educational potential and to increase awareness of inclusive values among all members of the university community.

The university experience is enriched by the diversity of viewpoints, values, and backgrounds that each class participant possesses. In order for this course to encourage as much insightful and comprehensive discussion among class participants as possible, there is an expectation that dialogue will be collegial and respectful across disciplinary, cultural, and personal boundaries.

STUDENT ASSISTANCE: Student Affairs and Services offers help and support in a variety of areas, both academic and personal. More information can be found at www.mun.ca/student.

CALENDAR ENTRY:

Process Dynamics and Control familiarizes students with the scientific and engineering principles of process dynamics and control. Students will apply and integrate knowledge of chemical engineering to identify, formulate and solve process dynamics problems and develop control systems. Modern computational techniques and tools will be used for solving chemical process control problems. Also students will become familiar with industrial control systems.

PREREQUISITES:	PROC 6021 or the former ENGI 6621 or the former ENGI 5621
SCHEDULE:	Lectures: Mon., Wed., Fri. 10:00-10:50 am, Online Rooms on Brightspace
	Lab: Wed./Thu., 2:00-4:00pm (Manual for the lab activities will be posted as a separate document)
CREDIT VALUE:	3 credits

RESOURCES:

TEXT BOOK

- D.E. Seborg, T.F. Edgar, D.A. Mellichamp and Francis J. Doyle III. Process Dynamics and Control, Third Ed. (International Student Version), John Wiley & Sons Inc., 2011.

REFERENCES

- Process Control, Thomas E. marlin, 2nd Ed., McGraw Hill, 2000. ISBN 0070393621
- Chemical Process Control, G. Stephanopoulis, Prentice-Hall, 1984. (ISBN 0-13-128629-3)
- Practical Process Control: Using Loop-Pro Software (Control Station), Douglas J. Cooper, 2005.

COURSE SCOPE: Topic [# of lecture hours]

1. Introduction to process control [3]
2. Process Models [3]
3. ODE and Laplace Transformations [3]
4. Dynamic behaviour of processes [6]
5. Feedback [3]
6. PID controller [9]
7. Dynamics and stability of closed loop systems [3]
8. Frequency domain analysis [3]
9. Advanced topics [3]

OVERALL EDUCATIONAL OBJECTIVES:
- To introduce to the students dynamic process modelling and solution methods of such models.
- To introduce to the students classical as well as advanced process control concepts and theories, stability of feedback systems, design of PID controllers and controller tuning.

Contribution to professional component:
Engineering Science: 75%
Engineering Design: 25%

ASSESSMENT:

Homework Assignment	20%	(4% each)
Quizzes	15%	(5% each)
Midterm	15%	
Lab	25%	
Final Exam	25%	
Bonus Assignment	1.5%	

- The **dates** of quizzes, exams and assignment submission are listed on the last page of this outline.

- Homeworks should be submitted through the corresponding assignments folders on Brighspace. For **late** submission of an assignment, a deduction of **20%** marks for each day will be applicable.

- There are two bonus assignments, one in the first week and the other in the last week. The bonus assignment marks will be in addition to the overall marks out of 100%.

- If a student fails to attend a quiz or an exam without any prior notice, a mark of **zero** will be counted.

- If a student cannot attend the midterm exam or quiz 3 with prior notice and a valid reason, the percentage allocated to the item will be **transferred** to the final exam; for quizzes 1 and 2, the percentages will be transferred to the midterm exam.

- All exams and quizzes will be **open-book** administered through Brightspace; supplementary pages with necessary information will be supplied as required.

- Laboratory schedules and **due dates for report submissions** are provided in the laboratory manual.

LEARNING OUTCOMES:

Learning Outcomes	Indicator of Attributes (Proficiency Level)	Method of Assessment
1. Explain rationale behind control systems and state typical components of modern control systems.	PA.2(A)	Assignments/ Exams
2. Develop dynamic models of simple systems from first-principles.	KB.1(A) PA.1(A)	Exams
3. Use mathematical tools to represent dynamic models for control design and study the dynamic response of different systems to standard inputs.	Tools.1(A)	Assignments/ Simulation Lab
4. Design classic PID controller systems and tune their parameters.	Des.1(A)	Assignments/ Exams
5. Analyse the stability of feedback control systems.	Inv.2(D)	Assignments/ Exams
6. Apply control to real as well as simulated process systems.	Tools.1(A)	Simulation Lab
7. Effectively participate in a team.	Team.2(D)	Simulation Lab
8. Demonstrate written communication skills.	Comm.1(D)	Simulation Lab

ONLINE CLASSROOM POLICIES:

- **Learn together**: A class is a learning community; although you are physically separated, please use useful communication channels to keep in touch with fellow students, to study together and learn from each other.

- **Attend**: You are strongly encouraged to **attend every lecture**, share your knowledge and understanding, and participate in the problem solving activities.

- **Avoid distraction**: No activity that might cause distraction of a student or the instructor will be allowed during lectures.

- **Use audiovisual aids**: Use of video is optional; however, it is encouraged that you use the audio communication tool for asking and answering questions. The chat option can also be used for the same purposes.

- **You are part of the recording**: All lectures will be recorded and posted on the course webpage. Your video, audio and chat inputs will be part of the recordings. However, the recorded videos will not be used for any other purposes and will not be posted anywhere else.

- **Etiquette**: Although online, everyone should follow the etiquettes for classrooms. Everyone should be respectful to others, their opinions as well as time.

- **Reduce noise**: To minimize audio noise, it is suggested that you keep your microphone muted unless you are communicating with the instructor or answering and asking questions.

- **Policy guideline**: The policies used in the course will be governed by the General Academic Regulations (Undergraduate) outlined in Section 5 of the academic calendar.

NOTES ON ONLINE EXAMS:

- Online exams will typically have both of the following components: (i) short answers and choice type answers (selecting from a list) to be submitted through the Brightspace quiz tool, (ii) detailed answers involving numerical calculations to be written on paper and scanned copy submitted through the assignment tool.

- The two parts will have time allocated separately. Additional time will be allocated for scanning and submission.

ACADEMIC INTEGRITY AND PROFESSIONAL CONDUCT:

Students are expected to conduct themselves in all aspects of the course at the highest level of academic integrity. Any student found to commit academic misconduct will be dealt with according to the Faculty and University practices. More information is available at
http://www.mun.ca/engineering/undergrad/academicintegrity.php

Students are encouraged to consult the Faculty of Engineering and Applied Science Student Code of Conduct at https://www.mun.ca/regoff/calendar/sectionNo=ENGI-1789 and Memorial University's regulations relating academic misconduct at
https://www.mun.ca/regoff/calendar/sectionNo=REGS-0748

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ETHICAL GUIDELINE FOR REMOTE EVALUATION

All remote evaluations will be unproctored in Spring 2021, as such it bestows additional responsibilities on the students. In addition to the policies and guidelines outlined in the "Academic Integrity and Professional Conduct", by enrolling in this course you will adhere to the following rules to maintain the integrity of the remote evaluation.

- You will only access materials (web and non web based) as specified in each exam instruction.

- You will not receive any unauthorized aid on this examination from any person. This includes but not limited to peers in your cohort or any other cohort, expert in the area paid or unpaid.

- You will not publish the question in any website, or any private or public discussion forum.

- You will not solicit solution from any paid or unpaid web based tutoring, discussion forum and similar sources.

- You will not provide the solution to any of your peers in the cohort or publish the answer in any public or private forum.

- You will not participate in, any behavior that may be disruptive, unprofessional, or that could reasonably be perceived as academic misconduct.

- If you witness or have knowledge of any unauthorized aid/activity on this examination, you will have the moral obligation to report this in confidence to the instructor.

MEMORIAL UNIVERSITY

Faculty of Engineering and Applied Science

Term-wide activities: The course will follow the schedule listed below. Any change of date for the assessment items should be agreed upon by the instructor and the students; such changes will be posted on the course page.

Wk	Lecture No.	Date	Activity	Comments
1	1	May-10		
	2	12		
	3	14	Bonus assignment (0.5%)	
2	4	17		
	5	19		
	6	21		
3	7	24	HW 1 due, Quiz 1	
	8	26		
	9	28		
4	10	31		
	11	June – 2		
	12	4		
5	13	7	HW 2 due, Quiz 2	
	14	9		
	15	11		
6	16	14		
	17	16		
	18	18		
7	19	21	Spring Break	
	20	23	Spring Break	
	21	25	HW 3 due, Midterm Review	
8	22	28	Midterm Exam	
	22	30		
	24	July - 2		
9	25	5		
	26	7		
	27	9		
10	28	12		
	29	14		
	30	16	HW 4 due, Quiz 3	
11	31	19		
	32	21		
	33	23		
12	34	26		
	35	28		
	36	30		
13	37	Aug – 2	HW 5 due	
	38	4	Final Exam Review	
	39	6	Bonus assignment (1%)	