

Supply Chain Management
Course Number: 29:799:460
Course Title: Introduction to Six Sigma and Lean Manufacturing

COURSE DESCRIPTION

This course provides fundamentals of six sigma, lean manufacturing, methodology and tools along with change management and other important strategies to improve the performance of business processes. Topics covered will include: six sigma improvement methodology and tools, lean thinking tools and cultural approach, dashboards, process mapping, applied statistics and other business improvement techniques. Students will gain an understanding of: the strategic importance of business improvement, the need for fact based management and how to deploy these tools in different parts of the value chain.

The course is structured as a combination of lectures, class discussions, case studies and team exercises.

COURSE MATERIALS

Recommended Software

1. Minitab (<http://www.minitab.com/en-us/academic/pricing>).

Textbooks

2. Mike Rother and John Shook, *Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA*. Lean Enterprise Institute, 1999. (Abbreviated as *Learning to See*) **ISBN: 0966784308**
3. Howard S. Gitlow, Richard J. Melnyck and David M. Levine, *A Guide to Six Sigma and Process Improvement for Practitioners and Students*. Pearson, 2015 (2nd edition). (Abbreviated as *Six Sigma*) **ISBN: 9780133925364**

Class-related materials (lecture notes, homework assignments, etc.) will be posted on Canvas (<http://canvas.rutgers.edu>). Additional visual material and demos may be shown in some lectures.

LEARNING GOALS AND OBJECTIVES

This course is designed to help students develop skills and knowledge in the following areas:

1. Knowledge: Students will have broad understanding of basic business theory and practice and deep understanding of theory and practice within supply chain management. Students who complete this course will demonstrate the following:

- a. Knowledge of current advanced concepts within supply chain management and an ability to integrate and apply these concepts to practical business problems.
 - Successful students will demonstrate their knowledge of manufacturing and operations planning concepts to ensure efficient and effective operations in business.
 - b. Proficiency at using current software tools and information systems to manage business data and address practical business problems.
 - c. Ability to apply appropriate quantitative methods to analyze business data, and to apply quantitative modeling techniques to analyze business plans and decisions.
2. Effective Communication: Students will be effective communicators. Students who complete this course will demonstrate the following:
- a. Ability to construct clear, concise, and convincing written business communication.
 - b. Ability to construct and deliver clear, concise, and convincing oral communication.

Students develop these skills and knowledge through the following course activities and assignments:

1. Knowledge: Lectures provide core knowledge of lean six sigma and how improvement strategies apply in a complex business environment, especially in supply chain operations, manufacturing and service management. Students will establish an appreciation of operational excellence through linkage between business improvement strategies and business performance. Lean six sigma principles are grounded on data-oriented decision making, and therefore students will learn to use quantitative data analysis tools to quantify characteristics of business problems, derive cause-and-effect relationship, brainstorm and prioritize solutions, and report to stakeholders. The homework assignments and the term project enhance the learning in real-life business scenarios, and the exams test the degree to which students acquire the requisite knowledge.
2. Persuasive communication: Having the best idea without an effective means of communication is no solution. Class discussions encourage students' participation and active communication. In the term project, students will produce a team report and deliver a presentation in a team setting. It is geared to enhance student skills to engage audience and present ideas effectively and efficiently, both in oral and written formats.

PREREQUISITES

None. However, basic knowledge of statistics is very helpful.

ACADEMIC INTEGRITY

I do NOT tolerate cheating. Students are responsible for understanding the RU Academic Integrity Policy <http://academicintegrity.rutgers.edu/>

I will strongly enforce this Policy and pursue *all* violations. On all examinations and assignments, students must sign the RU Honor Pledge, which states, "On my honor, I have neither received nor given any unauthorized assistance on this examination or assignment." I will screen all written assignments through *SafeAssign* or *Turnitin*, plagiarism detection services that compare the work against a large

database of past work. Don't let cheating destroy your hard-earned opportunity to learn. See business.rutgers.edu/ai for more details.

ATTENDANCE AND CLASSROOM CONDUCT

Every student is expected to contribute to class discussions. Continuing, thoughtful, and thorough participation in all aspects of the class will enable students to maximize their benefit from this course. Class activities (e.g., group exercises) and discussions are designed to help understand the lecture notes. Attending classes and participating in these activities will earn you class participation credits.

The following general rules will apply:

- Students are expected to attend all class sessions, arrive on time, and stay for the entire class session. If a student is to be absent, the student should notify the instructor in advance and get approved. If the absence is due to religious observance, a Rutgers-approved activity, illness, or family emergency/death, also send the instructor full details and supporting documentation within one week of your absence.
 - Since class attendance is expected, students are responsible for all announcements made or material handed out in class, regardless of their attendance.
 - In the unlikely event that the instructor cannot make it to class, students will be notified via email and Canvas as far in advance as possible.
 - Attend with an open mind and engage in class discussions. All discussions should be conducted in a respectful and civil manner. Questions regarding the lecture contents are highly encouraged during and after class.
 - A quick and quiet clarification or question of a classmate is acceptable but keep side conversations to a minimum as to not disrupt the class for your peers.
 - Email, web surf, text and use cell phones before and after class – not during. Laptops or tablets will be allowed in class for reading and taking notes, but not other activities unrelated to this course.
 - All unauthorized recordings of class lectures/discussions are prohibited.
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HOMEWORK ASSIGNMENTS

There are several homework assignments. They are practical reinforcements and complement what is taught in class. Detailed instructions on these assignments will be posted on Canvas, and the completed assignments should be submitted in class on the due date specified. You will receive feedback and a score for each assignment submitted. This will be based on how well you understand the lean six sigma concepts and how well you apply the tools.

The following policies will apply:

- Late submissions will **not be accepted** unless approved in advance for a valid reason (e.g., illness, family emergency, work emergency, etc.)

- Students should feel free to communicate with the instructor to ask for clarifications of the homework assignment questions. However, pre-grading will not be practiced.
 - Homework grades may be adjudicated at the discretion of the instructor, but not later than 2 weeks after being assigned.
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TERM PROJECT

The objective of the term project is to identify a process of your choice and develop an improvement strategy using lean six sigma concepts and tools. Students will team up into groups for this project. The final deliverables include **a presentation deck and a report** (to be submitted electronically). Each project team will give a presentation in class.

The following guidelines will apply:

- The chosen process must be a **real process**, cannot be theoretical or fictional.
- The presentation deck should focus on effective communication and must be **no more than 10 slides** (excluding the title page).
- The project report should include all details that the team wants the instructor to evaluate.
- The project score is judged by both the quality of work (importance, comprehensiveness, workload, etc.) and the effectiveness of presentation (clarity, time control, engagement, teamwork, Q&A, etc.).
- Team members are expected to contribute roughly equally. Otherwise, team members can specify the percentage contribution of each member in the project report (if not specified, equal contribution is assumed). The project will be graded as a whole but each team member's grade also depends on the individual contribution as reported.

Suggested project outline:

- Objective, scope, and business case
 - Value stream map / process flowchart
 - Measurements and data collection
 - Data visualization and process sigma
 - Fishbone diagram and analytics to support root cause
 - Solution prioritization matrix and risk control
 - Implementation strategy and (expected) outcome
 - How the process will remain "in-control"
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EXAMS

There will be two **closed book** exams. During the exams, the following rules will apply:

- If you have a disability that influences testing procedures, please provide the instructor an official letter from the Office of Disability Services at the start of the semester.

- During the exams, you may use a simple calculator, but all other electronic devices (e.g., cell phones and laptops) must be turned off and stowed. You cannot use your cell phone as a calculator.
- Use the bathroom prior to the exam start; bathroom breaks, if essential, will be escorted.

There will be no make-up exams unless a special event out of your control (e.g., a medical emergency) happens and prevents you from attending the scheduled exams. In such cases, you must notify the instructor as soon as you can and provide necessary documentations (e.g., a doctor’s note).

Exams will not be returned after grading. Students who would like to review their graded exams can come to office hours or make an appointment.

GRADING POLICY

Final course grades are determined based on a total score computed as a weighted sum of the following grade components:

Class Participation	10%
Homework	20%
Term Project	25%
Midterm Exam	20%
<u>Final Exam</u>	<u>25%</u>
Total	100%

The following policies will apply to grading:

- Your grades of each component and final numerical grade will be posted on Canvas. Your final letter grade is **based on the ranking** of your final numerical grade and will be posted on REGIS.
- There is no extra credit in addition to the grade components above.
- Please keep in mind that your final grade is not subject to negotiation. Your final grade will be adjusted only if a grading error is identified. If you believe there is a grading error, you should ask for a review meeting within one week of receiving your grade. Final grades will not be adjusted based on consequences, such as hurt pride, lost scholarships, lost tuition reimbursement, lost job opportunities, or dismissals, as it is dishonest to attempt to influence faculty in an effort to obtain a grade that you did not earn.
- Warning grades may be issued on REGIS at the mid-point of the semester as necessary.

COURSE SCHEDULE

Note that the following schedule may be modified by the instructor if necessary.

Day	Topic	Key Concepts	Recommended Reading
1	Course Overview; Lean Six Sigma Introduction	<input type="checkbox"/> Course introduction and <input type="checkbox"/> administration <input type="checkbox"/> Lean and Six Sigma history <input type="checkbox"/> Strategic business benefits	
2 – 6	Lean Concepts; Value Stream Mapping; Lean Culture and Tools; Toyota Production System	<input type="checkbox"/> Value added and non-value added <input type="checkbox"/> Eight wastes of lean <input type="checkbox"/> Value stream mapping <input type="checkbox"/> Lean thinking and culture <input type="checkbox"/> Lean tools <input type="checkbox"/> Toyota Production System	<i>Learning to See</i>
7	Six Sigma Overview; Minitab Introduction	<input type="checkbox"/> Six Sigma overview <input type="checkbox"/> DMAIC introduction <input type="checkbox"/> Minitab introduction	<i>Six Sigma</i> (Ch. 9)
8 – 9	Six Sigma: Define	<input type="checkbox"/> VOC <input type="checkbox"/> CTQ <input type="checkbox"/> SIPOC <input type="checkbox"/> Team charter	<i>Six Sigma</i> (Ch. 10)
10 – 12	Six Sigma: Measure	<input type="checkbox"/> Process flowchart <input type="checkbox"/> Process yield <input type="checkbox"/> Specification limit <input type="checkbox"/> Measurement system analysis <input type="checkbox"/> Data collection <input type="checkbox"/> Basic statistics <input type="checkbox"/> Process sigma	<i>Six Sigma</i> (Ch. 11)
13	Midterm Review		
14	Midterm Exam		
15 – 18	Six Sigma: Analyze	<input type="checkbox"/> 5-Whys <input type="checkbox"/> Fishbone diagram <input type="checkbox"/> Control chart <input type="checkbox"/> Pareto chart <input type="checkbox"/> Hypothesis testing <input type="checkbox"/> Regression analysis <input type="checkbox"/> Design of Experiments (DOE)	<i>Six Sigma</i> (Ch. 12)
19 – 21	Six Sigma: Improve	<input type="checkbox"/> Brainstorming <input type="checkbox"/> Solution prioritization matrix <input type="checkbox"/> Implementation <input type="checkbox"/> Risk assessment (FMEA)	<i>Six Sigma</i> (Ch. 13)
22	Six Sigma: Control	<input type="checkbox"/> Sustaining the gains <input type="checkbox"/> Statistical process control <input type="checkbox"/> Documentation (SOP) <input type="checkbox"/> Control plans (PDCA)	<i>Six Sigma</i> (Ch. 14)
23	Design for Six Sigma	<input type="checkbox"/> DMAIC practice <input type="checkbox"/> DFSS introduction	

24	Change Management	<input type="checkbox"/> Change management concepts	<i>Six Sigma</i> (Ch. 16)
25	Final Review		
26 – 28	Term Project	<input type="checkbox"/> Presentation and report	
29	Final Exam	<input type="checkbox"/> Per the university final exam schedule	

SUPPORT SERVICES

If you need accommodation for a *disability*, obtain a Letter of Accommodation from the Office of Disability Services. The Office of Disability Services at Rutgers, The State University of New Jersey, provides student-centered and student-inclusive programming in compliance with the Americans with Disabilities Act of 1990, the Americans with Disabilities Act Amendments of 2008, Section 504 of the Rehabilitation Act of 1973, Section 508 of the Rehabilitation Act of 1998, and the New Jersey Law Against Discrimination. More information can be found at ods.rutgers.edu.

[Rutgers University-New Brunswick ODS phone (848)445-6800 or email dsoffice@echo.rutgers.edu]

[Rutgers University-Newark ODS phone (973)353-5375 or email ods@newark.rutgers.edu]

If you are *pregnant*, the Office of Title IX and ADA Compliance is available to assist with any concerns or potential accommodations related to pregnancy.

[Rutgers University-New Brunswick Title IX Coordinator phone (848)932-8200 or email jackie.moran@rutgers.edu]

[Rutgers University-Newark Office of Title IX and ADA Compliance phone (973)353-1906 or email TitleIX@newark.rutgers.edu]

If you seek *religious accommodations*, the Office of the Dean of Students is available to verify absences for religious observance, as needed.

[Rutgers University-New Brunswick Dean of Students phone (848)932-2300 or email deanofstudents@echo.rutgers.edu]

[Rutgers University-Newark Dean of Students phone (973)353-5063 or email DeanofStudents@newark.rutgers.edu]

If you have experienced any form of *gender or sex-based discrimination or harassment*, including sexual assault, sexual harassment, relationship violence, or stalking, the Office for Violence Prevention

and Victim Assistance provides help and support. More information can be found at <http://vpva.rutgers.edu/>.

[Rutgers University-New Brunswick incident report link: <http://studentconduct.rutgers.edu/concern/>. You may contact the Office for Violence Prevention and Victim Assistance at (848)932-1181]

[Rutgers University-Newark incident report link: https://cm.maxient.com/reportingform.php?RutgersUniv&layout_id=7 . You may also contact the Office of Title IX and ADA Compliance at (973)353-1906 or email at TitleIX@newark.rutgers.edu. If you wish to speak with a staff member who is confidential and does **not** have a reporting responsibility, you may contact the Office for Violence Prevention and Victim Assistance at (973)353-1918 or email run.vpva@rutgers.edu]

If students who have experienced a temporary condition or injury that is adversely affecting their ability to fully participate, you should submit a request via <https://temporaryconditions.rutgers.edu>.

If you are a military **veteran** or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services. <http://veterans.rutgers.edu/>

If you are in need of **mental health** services, please use our readily available services.

[Rutgers University-Newark Counseling Center: <http://counseling.newark.rutgers.edu/>]

[Rutgers Counseling and Psychological Services–New Brunswick: <http://rhscaps.rutgers.edu/>]

If you are in need of **physical health** services, please use our readily available services.

[Rutgers Health Services – Newark: <http://health.newark.rutgers.edu/>]

[Rutgers Health Services – New Brunswick: <http://health.rutgers.edu/>]

If you are in need of **legal** services, please use our readily available services: <http://rusls.rutgers.edu/>

Students experiencing difficulty in courses due to **English as a second language (ESL)** should contact the Program in American Language Studies for supports.

[Rutgers–Newark: PALS@newark.rutgers.edu]

[Rutgers–New Brunswick: eslpals@english.rutgers.edu]

If you are in need of additional *academic assistance*, please use our readily available services.

[Rutgers University-Newark Learning Center: <http://www.ncas.rutgers.edu/rlc>

[Rutgers University-Newark Writing Center: <http://www.ncas.rutgers.edu/writingcenter>]

[Rutgers University-New Brunswick Learning Center: <https://rlc.rutgers.edu/>]

[Optional items that many faculty include:

- Students must sign, date, and return a statement declaring that they understand the RU Academic Integrity Policy.

- Students must sign, date, and return a statement declaring that they understand this syllabus.]