MANUFACTURING PROCESS CONTROL

1	Course Title:	MANUFACTURING PROCESS CONTROL	
2	Course Code:	END5117	
3	Type of Course:	Optional	
4	Level of Course:	Third Cycle	
5	Year of Study:	1	
6	Semester:	1	
7	ECTS Credits Allocated:	7.50	
8	Theoretical (hour/week):	3.00	
9	Practice (hour/week):	0.00	
10	Laboratory (hour/week):	0	
11	Prerequisites:	None	
12	Language:	Turkish	
13	Mode of Delivery:	Face to face	
14	Course Coordinator:	Doç.Dr. ALI YURDUN ORBAK	
15	Course Lecturers:		
16	Contact information of the Course Coordinator:	orbak@uludag.edu.tr, 0(224)2942086, Uludağ Üniversitesi Endüstri Mühendisliği Bölümü Oda Y315 Görükle, 16059, Bursa	
17	Website:	http://endustri.uludag.edu.tr/~orbak/END5117.html	
18	Objective of the Course:	The objective of this subject is to understand the nature of manufacturing process variation and the methods for its control. First, a general process model for control is developed to understand the limitations a specific process places on the type of control used. A general model for process variation is presented and three methods are developed to minimize variations: Statistical Process Control, Process Optimization and in-process Feedback Control. These are considered in a hierarchy of cost-performance tradeoffs, where performance is based on changes in process capability. The idea of control systems and its relationship to process physics is shown in many special manufacturing processes.	
19	Contribution of the Course to Professional Development:	Students learn the ability to analyse common structures of several manufacturing systems used in production.	
20	Learning Outcomes:		
		1	Students will be albe to identify the suitable feedback control method fort he process and design it.
		2	Students will understand the physics of industrial manufacturing processes, model and classify them.
		3	Students will be able to utilize optimization, statistical quality control and similar tools.
		4	Students will be able to understand the underlying physics of the processes and they will amprically/adaptively model it for a suitable control algorithm.
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21	Course Content:		
	Course Content:		

Week	Theoretical	Practice
1	Introduction to manufacturing processes	
2	Principles of process modeling for control	
3	Reasons of variability	
4	Nature of variablity in processes	
5	Feedback control for process improvement: Basic servo problem	
6	Position servo analysis and cycle to cycle control	
7	Discrete systems and discrete system closed loop Dynamics	
8	Use of cycle to cycle control to reduce variability in various manufacturing processes	
9	Describing Variation: Probability and Random Variables	
10	Shewhart Model of Manufacturing and "Charting"	
11	SPC Charting and Process Capability	
12	Advanced SPC: Moving Average Approaches	
13	Introduction to Empirical Process Modeling and Optimization	
14	Designed Experiments: The 2-k Problem, Analysis of Variance and Model Testing	

Activites	Number	Duration (hour)	Total Work Load (hour)
Theoretical	14	3.00	42.00
Practicals/Labs	0	0.00	0.00
Self study and preperation	12	9.00	108.00
Homeworks	1	9.00	9.00
Projects	1	62.00	62.00
Field Studies	0	0.00	0.00
Midterm exams	0	2.00	0.00
Others	0	0.00	0.00
Final Exams	1	2.00	2.00
Total Work Load			223.00
Total work load/ 30 hr			7.50
ECTS Credit of the Course			7.50

• May, Gary S., and Costas J. Spanos. Fundamentals of Semiconductor Manufacturing and Process Control. New York, NY: Wiley-IEEE Press, 2006. ISBN: 9780471784067.

• Kalpakjian, S. Manufacturing Processes for Engineering Materials. 3rd ed. Menlo Park, CA: Addison Wesley, 1996. ISBN: 9780201824896.

For statistical analysis, SPC and design of experiments:
• Montgomery, D. C. Introduction to Statistical Quality Design and Control. New York, NY: Macmillan, 1992. ISBN: 9780023291807.

• Hogg, R. V., and J. Ledolter. Engineering Statistics. New York, NY: Macmillan, 1987. ISBN: 9780023557903.

• Bendat, J. S., and A. G. Piersol. Random Data. 2nd ed. New York, NY: Wiley Interscience, 2000. ISBN: 9780471317333.

For feedback control and stochastic control:
• Ogata, Katsuhiko. Modern Control Engineering. 3rd ed. Upper Saddle River, NJ: Prentice Hall, 1996. ISBN: 9780132273077.

• Friedland, B. Control System Design. New York, NY: McGraw Hill, 1985. ISBN: 9780070224414.

23	Assesment

TERM LEARNING ACTIVITIES	**NUMBER**	**WEIGHT**
Midterm Exam	0	0.00
Quiz	0	0.00

Home work-project	1	60.00
Final Exam	1	40.00
Total	2	100.00
Contribution of Term (Year) Learning Activities to Success Grade		60.00
Contribution of Final Exam to Success Grade		40.00
Total		100.00
Measurement and Evaluation Techniques Used in the Course		Midterm exam, homeworks/project and final exam is performed for evaluation.

24 ECTS / WORK LOAD TABLE

25 CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS

	PQ1	PQ2	PQ3	PQ4	PQ5	PQ6	PQ7	PQ8	PQ9	PQ10	PQ11	PQ12	PQ13	PQ14	PQ15	PQ16
ÖK1	0	4	4	4	0	4	0	4	0	4	4	4	4	0	0	0
ÖK2	0	4	4	4	0	4	0	4	0	4	4	4	4	0	0	0
ÖK3	0	4	4	4	0	4	0	4	0	4	4	4	4	0	0	0
ÖK4	0	4	4	4	0	4	0	4	0	4	4	4	4	0	0	0

LO: Learning Objectives PQ: Program Qualifications

Contribution Level:	**1 very low**	**2 low**	**3 Medium**	**4 High**	**5 Very High**