

WOLLO UNIVERSITY
COMBOLCHA INSTITUTE OF TECHNOLOGY
Industrial Engineering Department

IEng 3112 - Statistical Quality Control

Academic year 2020

Course Number: IEng 3112 Course Title: Statistical Quality Control Program: B.Sc. in Industrial Engineering Instructor: Dagne T.	Credit Hours: 3 Contact Hours: 2 Lecture & 3 Tutorial hrs.
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Course Objectives:

The objective of the course is to help students gain skills needed to apply statistical thinking to quality improvement using facts, data, and analysis. Develop and analyze process-appropriate charts.

After taking the course, students will be able to:

- ✓ Apply statistical thinking to quality improvement
- ✓ Use statistical tools to analyze a wide variety of daily work problems
- ✓ Select appropriate control charts for different applications
- ✓ Interpret variability in work processes
- ✓ Construct a histogram of a set of data
- ✓ Develop and analyze run charts and control charts for variables and attributes data
- ✓ Quantify process capability through data analysis and control charts
- ✓ Compute and interpret process capability indexes

Course Description:

This course presents current information and methods associated with achieving statistical process control of processes. Primary focus is placed on process control for variables data. The Course content includes the practical, procedural, and theoretical information which is prerequisite to the engineer designing and establishing SPC systems. State-of-the-art technology software for shop floor SPC is also discussed.

WEEKS	COURSE OUTLINES:	ACTIVITIES TO BE PERFORMED		
Week 1 March 16 to 20/2020	1. Introduction to Statistical Process Control <ul style="list-style-type: none"> ✓ Total Quality Management and Statistical Process Control ✓ Quantifying Variation ✓ Approaches to Continuous Improvement <ul style="list-style-type: none"> ▪ The Deming Cycle ▪ Juran's Improvement Program. 	Quiz 1		
Week 2 to 3 March 23 to Apr 3/2020	2. Statistical Tools for Problem Solving <ul style="list-style-type: none"> ✓ Statistical Thinking ✓ Measurement and Data Collection <ul style="list-style-type: none"> ▪ Types of Data ▪ Accuracy and Precision ✓ Populations and Samples 	Assignment		

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	<ul style="list-style-type: none"> ✓ Fundamental Statistical Measures <ul style="list-style-type: none"> ▪ Measures of Central Tendency ▪ Measures of Variation ✓ Tools for Data Collection and Analysis <ul style="list-style-type: none"> ▪ Flowcharts, Check Sheets, Histograms, Pareto Diagrams, Cause-and-effect, Diagrams Scatter Diagrams, Control Charts etc. 	followed presentation	Mid-Exam	Industrial Visit
<p>Week 4 to 6 Apr 6 to 24/2020</p>	<p>3. Introduction to Control Charts</p> <ul style="list-style-type: none"> ✓ The Scope of Statistical Process Control ✓ Measurement and Control <ul style="list-style-type: none"> ▪ Advantages of Control ▪ Standards and Goals ▪ Process Measurement ▪ Corrective Action(s) ✓ Run Charts <ul style="list-style-type: none"> ▪ Constructing Run Charts ▪ Run Chart Example ✓ Interpreting Patterns in Run Charts <ul style="list-style-type: none"> ▪ Trends, Shifts in Level, Cycles, Spikes, Multiple Variable Run Charts etc. ✓ Control Charts <ul style="list-style-type: none"> ▪ Computing Control Limits ▪ Using Control Charts ✓ Implementing Statistical Process Control 	Test 1		
<p>Week 7 to 9 Apr 27 to May 15/2020</p>	<p>4. Control Charts</p> <p>4.1 For Variables Data-Part I</p> <ul style="list-style-type: none"> ✓ Variables Control Charts ✓ Constructing \bar{x}-bar and R-charts <ul style="list-style-type: none"> ▪ Evaluating the State of Control ✓ Interpreting Patterns in \bar{x}-bar and R-charts ✓ Using Control Charts for Continued Monitoring ✓ Maintaining Control Charts ✓ Fundamental Design Issues <ul style="list-style-type: none"> ▪ Basis for Sampling ▪ Sample Size 	Assignment, and Class - Discussion		

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	<ul style="list-style-type: none"> ▪ Sampling Frequency <p>4.2 For Variables Data-Part II</p> <ul style="list-style-type: none"> ✓ Alternatives to \bar{x}-bar and R-charts ✓ Constructing Standard Deviation Charts <ul style="list-style-type: none"> ▪ Example of Standard Deviation Calculation ✓ Charts for Individual Measurements <ul style="list-style-type: none"> ▪ Individual Measurements and Moving Ranges Example ✓ Selecting the Proper Variables Control Chart 	Followed by Presentations		
<p>Week 10 to 12 May 18 to June 5/2020</p>	<p>5. Control Charts for Attributes Data</p> <ul style="list-style-type: none"> ✓ Attributes Measurement and Control Charts ✓ p-chart for Fraction Defective <ul style="list-style-type: none"> ▪ Calculating the Proportion Nonconforming ✓ np-chart for Number Nonconforming ✓ p-chart with Variable Sample Sizes <ul style="list-style-type: none"> ▪ Constructing a p-chart with Variable Sample Sizes ▪ Approximate Control Limits ▪ Calculating Approximate Control Limits ▪ Variable Sample Sizes and np-charts ✓ Charts for Defects <ul style="list-style-type: none"> ▪ Constructing a c-chart ▪ Constructing a u-chart ✓ Selecting Attributes Control Charts <ul style="list-style-type: none"> ▪ Using the c-chart ▪ Using the u-chart 	Test 2	Final-Exam	
<p>Week 13 to 15 June 8 to 26/2020</p>	<p>6. Process Capability</p> <ul style="list-style-type: none"> ✓ The Concept of Process Capability <ul style="list-style-type: none"> ▪ Variation and Specifications Capability and Control ✓ Process Capability Studies ✓ Measuring Process Capability <ul style="list-style-type: none"> ▪ Estimating Process Capability from Descriptive Statistics ▪ Example of Descriptive Statistics ▪ Estimating Process Capability from Control Charts ✓ Process Capability Index 	Quiz 2		

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	<ul style="list-style-type: none"> ▪ One-sided Process Capability Indexes Cpk. ✓ Reliability Engineering <ul style="list-style-type: none"> ▪ Basic Principles of Reliability, Reliability Estimation and Improvement 			
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Pre-requisites:

- Probability and Statistics for Engineers

Semester:

- Year 3, Semester II

Teaching Methods:

- Lectures supported by tutorials
- Assignments followed by presentations.
- Industrial visit (if the situations are allowed)

Attendance Requirement:

- Minimum of 80% attendance during lecture hours;
- 100% attendance during tutorials and industrial visits, except for some unexpected mishaps.

Evaluation:

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| ▪ Quizzes | 10% |
| ▪ Tests | 10% |
| ▪ Assignments, Discussions and Visit Report followed by Presentations | 20% |
| ▪ Mid - Exam | 20% |
| ▪ Final - Examination | 40%. |

References

1. Douglas C. Montgomery, *Introduction to Statistical Quality Control*, 5th edition, John Wiley & Sons, 2005.
2. D.C. Montgomery, *"Design and Analysis of Experiments"*, John Wiley, 4th Edition, 1997
3. Wayne Nelson, *"Accelerated Testing, statistical models, test plans, and data analyses"*, John Wiley, 1990
4. Dale H. Besterfield, *Quality Control*, six edition, Prentice Hall, 2001
5. AmitavaMitra ,*Fundamentals of Quality control and improvement* ,2004
6. M. Mahajan ,*Statistical Quality Control* , 2005
7. Mitra. *Fundamentals of Quality Control and Improvement*, 2nd Edition, Pearson Education
8. Dennis F. kehoe (1997). *The Fundamentals of Quality Management*.
9. Evans. Lindsay (2003). *The Management and Control of Quality*, 3rd Edition.
10. Burt Dobler Starling (2006). *World Class Supply Management*, 7th Edition