UNIVERSITY OF GHANA

BSc. (Eng) MATERIALS SCIENCE AND ENGINEERING

FIRST SEMESTER EXAMINATIONS 2015/2016

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

MTEN 405: PROCESS AND QUALITY CONTROL (3 CREDITS)

TIME- 2½HRS

ANSWER ALL QUESTIONS

1.

a. Explain the 3 main types of control **(3 marks)**

b. With reference to the International Standards Organization's standards, briefly explain four (4) standard quality management principles. **(4 mark)**

c. State the five (5) sections under the ISO 9001 that specify activities that need to be considered when implementing this system. **(5 marks)**

d. Briefly describe the five principal approaches in defining quality. **(10 marks)**

e. State six (6) Characteristics of a Total Quality Management Leader. **(3 marks)**

2.

a. Briefly explain the following terms: Statistical process control, Variables, Attributes, Sampling plan, Sample size, Process capability, Nominal value, Tolerance, Quality engineering. **(9 marks)**

b. Briefly discuss the terms associated with statistical process control: control (c-) chart, range (R-) chart, mean ($\bar{x}$) chart. **(6 marks)**

c. State and describe the control limits for the $\bar{x}$ chat and R-charts **(10 marks)**

3.

a. State the laws of process control **(3 marks)**

b. In the Super Paper Company's final step in their paper production process, the paper passes through a machine that measures various product quality characteristics. When the paper production process is in control, it averages 20 defects per roll.

    i. Set up a control chart for the number of defects per roll. Use two-sigma control limits. **(2 marks)**

Examiner: Dr. David Dodoo-Arhin

ii. Five rolls had the following number of defects: 16, 21, 17, 22, and 24, respectively. The sixth roll, using pulp from a different supplier, had 5 defects. Is the paper production process in control? **(2 marks)**

c. Using the appropriate formulae, explain the following: Process Capability Index, C_{pk} and Process Capability Ratio, C_p **(10 marks)**

d. At Webster chemical company, lumps in the caulking compound could cause difficulties in dispensing a smooth bead from the tube. Even when the process is in control, there will still be an average of 4 lumps per tube of caulk. Testing for the presence of lumps destroys the product. So Webster takes random samples. The following are results of the study. Determine the c-chart six sigma upper and lower control limits for this process.

Tube #	Lumps	Tube #	Lumps
1	6	7	1
2	5	8	6
3	0	9	5
4	4	10	0
5	6	11	9
6	4	12	2

4.

a. The cost of quality is generally classified into four categories. State and explain the categories **(4 marks)**

b. State 4 Important Characteristics of Process Control Systems **(2 marks)**

c. The intensive care unit lab process has an average turnaround time of 26.2 minutes and a standard deviation of 1.35 minutes. The nominal value for this service is 25 minutes with an upper specification limit of 30 minutes and a lower specification limit of 20 minutes. The administrator of the lab wants to have 4-sigma performance for her lab. Is the lab process capable of this level of performance? **(3 marks)**

d. State 6 control objectives you will consider when you want to attain a process desired value. **(6 marks)**

e. Briefly state and explain 5 concepts that Control Engineering does "Engineer"? **(10 marks)**