043

FACULTY OF ENGINEERING TECHNOLOGY
POSTGRADUATE DIPLOMA IN TECHNOLOGY
IN INDUSTRIAL ENGINEERING LEVEL 7
FINAL EXAMINATION – 2008/2009

MEX7214 – QUALITY AND RELIABILITY ENGINEERING
DATE : 21 March 2009
TIME :1400 -1700 Hrs
DURATION : THREE (03) HOURS

Answer any five (05) questions. All questions carry equal marks.
Normal Distribution Table and coefficients of $\bar{x}$- R control charts are provided.

1. (a) Quality is a term that has been defined in many ways. Over the years experts and organizations have attempted to define quality. The result is the emergence of several definitions. Discuss any two such definitions of quality. Support your answer with appropriate examples.

   (b) Quality planning, Quality Control and Quality Improvement are three important phases in establishing a successful quality programme. They are also referred to as Quality Trilogy. Explain the important features of each of the three phases.

2. Comment on the following statements.

   (a) "Quality of specification of a product is a vital factor for implementing a quality programme".

   (b) "Standardization practices at enterprise / Company level will help to maintain product quality".

3. (a) Explain the following terms with suitable examples.

   (i) Availability (ii) Reliability (iii) Maintainability

   (b) Failure Mode and Effect Analysis provide a methodical way to examine a product design for possible ways of failure.

   Explain the steps of performing this type of analysis.

   (c) 10 motors were tested for 500 hours, each under same operating conditions. It was observed that 6 motors failed after the following time periods.

   1st motor failed after 100 hours.
   2nd motor failed after 150 hours.
   3rd motor failed after 200 hours.
   4th motor failed after 300 hours.
   5th motor failed after 350 hours.
   6th motor failed after 400 hours.

   What is the failure rate of the motors?

4. Write an account on each of the following statements.

   (a) "Improvement cannot be achieved by strengthening control activities only, bu it needs a breakthrough procedure".

   (b) "Total Quality Management concepts will not only improve product quality bu will improve performance of the entire organization".

   (c) "Internal customer concept if practiced effectively will improve processes an strengthen relationships between employees at different levels of a organization".

5. A certain process produces metal pieces having a length normally distributed wi standard deviation 1.2mm. These metal pieces are used for the assembly of the en product. Pieces less than 100 mm length are undesirable for the assembly proces However, a temporary concession has been given to accept 0.5% pieces having lengt less than 100 mm.

   (a) Under the temporary concession what should be the mean value of the process'

   (b) In the above process pieces having lengths greater than 105 mm a unacceptable and no concession can be allowed. If the upper specification lim is considered critical, is the process capable of meeting the supper specificati limit?

   (c) If the process is to be improved so that the pieces meet specification limi what should be the minimum standard deviation ?

6. Explain each of the following statements giving suitable examples.

   (a) There is no guarantee that statistically controlled process will produce produ conforming to specification.

   (b) "Statistical approach" consists of concepts and practices for maintaining a improving quality.

   (c) Variation in product quality will affect profitability and competitiveness.

7. (a) Mean-Range control chart has to be installed to a process producing a circu pin. The diameter of the pin is regarded as an important quality characteristic be controlled. Explain briefly in a step-wise manner how you would proceed install the control chart. If the company specification is given what further ste you would take to authorize the use of the control chart for future production.

   (b) Control charts for mean-range are maintained on the diameter of the p produced by a machine. 4 pieces at a time were taken during the installation the control charts. $\bar{x}$ and R values were computed for 20 sub-groups. Sum of values was 204 cm and sum of R values was 50mm. The company specificat for the pin is (10.25 ± 0.25) cm According to the control charts the process is statistical control. What is your inference regarding the process meet specification ?

8. (a) In order to maintain and improve quality it is important to motivate factory floor workers continuously. However, motivation is not the only answer to reduce errors and defects caused by workers. How do you approach to analyse errors and defects caused by workers and what are the remedial actions you would suggest to minimize such errors and defects?

(b) ABC Company is exporting garments to several buying organizations. Garments are manufactured at ABC Company using imported raw materials. However, a few items required for the finished garment are locally purchased. The company is facing many problems with local suppliers. Defective items are causing machine stoppages and considerable downtime. It also affects the quality of the finished product and in order to maintain quality the company has to undertake lot of inspection. Incoming inspection is also carried out but has no appreciable effect on improving the situation.

(i) All these inspections have added to the cost of manufacturing. If you are assigned the task of suggesting solutions to the problem, how would you proceed to work on it ?

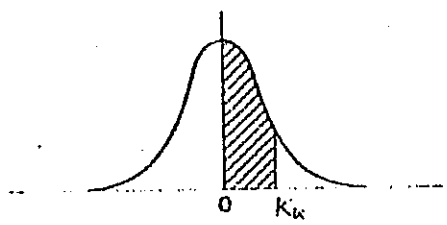
(ii) Also what meaningful steps would you propose to reduce the cost of manufacturing?

Coefficients for $\bar{x}$ - R charts

Sub Group Size(n)	A_2	D_3	D_4	d_2
2	1.880	-	3.267	1.128
3	1.023	-	2.575	1.693
4	0.729	-	2.282	2.059
5	0.577	-	2.115	2.326
6	0.483	-	2.004	2.534
7	0.419	0.076	1.924	2.704
8	0.373	0.136	1.864	2.847
9	0.337	0.184	1.816	2.970
10	0.308	0.223	1.777	3.078

Table A Normal Distribution Areas*

Fractional parts of the total area (1.000) under the normal curve between the mean and a perpendicular erected at various numbers of standard deviations (K) from the mean. To illustrate the use of the table, 39.065 percent of the total area under the curve will lie between the mean and a perpendicular erected at a distance of 1.23σ from the mean.



Each figure in the body of the table is preceded by a decimal point.

K	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	00000	00399	00798	01197	01595	01994	02392	02790	03188	03586
0.1	03983	04380	04776	05172	05567	05962	06356	06749	07142	07535
0.2	07926	08317	08706	09095	09483	09871	10257	10642	11026	11409
0.3	11791	12172	12552	12930	13307	13683	14058	14431	14803	15173
0.4	15554	15910	16276	16640	17003	17364	17724	18082	14839	18793
0.5	19146	19497	19847	20194	20540	20884	21226	21566	21904	22240
0.6	22575	22907	23237	23565	23891	24215	24537	24857	25175	25490
0.7	25804	26115	26424	26730	27035	27337	27637	27935	28230	28524
0.8	28814	29103	29389	29673	29955	30234	30511	30785	31057	31327
0.9	31594	31859	32121	32381	32639	32894	33147	33398	33646	33891
1.0	34134	34375	34614	34850	35083	35313	35543	35769	35993	36214
1.1	36433	36650	36864	37076	37286	37493	37698	37900	38100	38298
1.2	38493	38686	38877	39065	39251	39435	39617	39796	39973	40147
1.3	40320	40490	40658	40824	40988	41149	41308	41466	41621	41774
1.4	41924	42073	42220	42364	42507	42647	42786	42922	43056	43189
1.5	43319	43448	43574	43699	43822	43943	44062	44179	44295	44408
1.6	44520	44630	44738	44845	44950	45053	45154	45254	45352	45449
1.7	45543	45637	45728	45818	45907	45994	46080	46164	46246	46327
1.8	46407	46485	46562	46638	46712	46784	46856	46926	46995	47062
1.9	47128	47193	47257	47320	47381	47441	47500	47558	47615	47670
2.0	47725	47778	47831	47882	47932	47982	48030	48077	48124	48169
2.1	48214	48257	48300	48341	48382	48422	48461	48500	48537	48574
2.2	48610	48645	48679	48713	48745	48778	48809	48840	48870	48899
2.3	48928	48956	48983	49010	49036	49061	49086	49111	49134	49158
2.4	49180	49202	49224	49245	49266	49286	49305	49324	49343	49361
2.5	49379	49396	49413	49430	49446	49461	49477	49492	49506	49520
2.6	49534	49547	49560	49573	49585	49598	49609	49621	49632	49643
2.7	49653	49664	49674	49683	49693	49702	49711	49720	49728	49736
2.8	49744	49752	49760	49767	49774	49781	49788	49795	49801	49807
2.9	49813	49819	49825	49831	49836	49841	49846	49851	49856	49861
3.0	49865	49869	49874	49878	49882	49886	49889	49893	49896	49900
3.1	49903	49906	49910	49913	49915	49918	49921	49924	49926	49929
3.2	49931	49934	49936	49938	49940	49942	49944	49946	49948	49950
3.3	49952	49953	49955	49957	49958	49960	49961	49962	49964	49965

* This table has been adapted, by permission, from F. C. Kent, *Elements of Statistics*, McGraw-Hill Book Company, New York, 1924.