

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Examination July 2010

Subject code: 720909

Subject Name: Quality Control and Reliability

Date: 09 / 07 /2010

Time: 11.00am – 1.30pm

Total Marks: 60

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Notations carry usual meanings.

- Q.1 (a)** The number of non conforming microchips obtained from 20 random samples is shown in following table. The corresponding sample size is also indicated. Construct a suitable control chart by calculating control limits. What inference do you draw from the chart? **06**

Sample No.	Inspected Microchips	Non conforming Microchips	Sample No.	Inspected Microchips	Non conforming Microchips
1	50	4	11	80	6
2	90	6	12	120	8
3	100	8	13	100	21
4	90	7	14	80	5
5	80	8	15	110	8
6	40	3	16	40	6
7	50	6	17	40	4
8	50	6	18	50	7
9	110	8	19	120	5
10	70	6	20	50	4

- (b)** What do you mean by Quality of Design, Quality of Conformance and Quality of Performance? Show how they are interrelated. **06**
- Q.2 (a)** A sub-group of 5 items each are taken from a manufacturing process at a regular interval. A certain quality characteristic is measured and \bar{X} and R values are computed. After 25 subgroups it is found that $\sum \bar{X} = 357.5$ and $\sum R = 8.8$. If the specification limits are 14.4 ± 0.4 ; and if the process is in statistical control, what conclusions can you draw about the ability of the process to produce items within specifications? Suggest a remedy if process is not in control. (For sub group of 5 items $d_2 = 2.326$) **06**
- (b)** A double sampling plan is as follows: **06**
- a) Select a sample of 2 from a lot of 20. If both articles inspected are good, accept the lot. If both are defective, reject the lot. If 1 is good and 1 defective, take a second sample of one article.
 - b) If the article in the second sample is good, accept the lot. If it is defective reject the lot.
- If a lot 25% defective is submitted, what is the probability of acceptance? Compute this by the method that is theoretically correct rather than an approximate method.

OR

- (b) In the preparation of a drug, the percentage of calcium is a characteristic we want to control. Random samples of size 5 are selected, and the average percentage of calcium is found. The data values from 15 samples are shown in table below. From historical data, the standard deviation of the percentage of calcium is estimated as 0.2%. The target value for the average percentage of calcium is 26.5%. We decide to notice shift in the average percentage of calcium content of 0.1%. Assume Type I error level of 0.05. The value of scale factor is 0.125. Find out degree of shift in the process mean, lead distance, angle of decision line and cumulative sum. **06**

Sample	Average percentage of Calcium, \bar{X}	Sample	Average percentage of Calcium, \bar{X}	Sample	Average percentage of Calcium, \bar{X}
1	25.5	6	25.9	11	26.9
2	26.0	7	27.0	12	27.8
3	26.6	8	25.4	13	26.2
4	26.8	9	26.4	14	26.8
5	27.5	10	26.3	15	26.6

- Q.3** (a) The functioning of a strategic experiment is monitored continuously by two observation stations, A and B, functioning independently. It is necessary that at least one of them function satisfactorily to monitor the progress of the experiment. Each of these observation stations receives power supply from two independent sources connected in parallel. A receives power from C and D, and B receives from E and F. For each observation station, the power from any one source is sufficient for operation. Draw the block diagram and the fault-tree diagram for the system. **06**
- (b) Construct the cause and effect diagram for malfunction of an electric motor coupled with pump. **06**

OR

- Q.3** (a) Explain the following terms: **06**
1. Markov Graphs and Chain
 2. Reliability
 3. Inherent Availability
- (b) Mention the objectives, advantages and limitations of Quality Circles. **06**

- Q.4** (a) Explain the various pillars of TQM (Total Quality Management). **06**
- (b) Explain the Taguchi's principal in context of "Larger the better", "Smaller the better" and "Nominal the best" with suitable examples. **06**

OR

- Q.4** (a) Explain the mentioned clauses of ISO:9001 model **06**
1. Management Responsibility
 2. Internal Quality Audit
- (b) Explain the following terms: **06**
1. Quality Assurance
 2. Jidoka and Pull System
 3. Consumer's risk and producer's risk

- Q.5** (a) Explain the Deming cycle and its role in quality improvement. **06**

- (b) In a test involving continuous satisfactory performance of 140 electronic microchips under excessive vibration conditions, the following failure frequencies were observed, the total test period being 7 hours. Find failure density, failure rate, reliability and probability of failure in tabulate format. **06**

Time interval(hrs)	0-1	1-2	2-3	3-4	4-5	5-6	6-7
No. of failures	10	20	30	42	21	10	07

OR

- Q.5 (a)** Tests have indicated that the tensile strengths of certain aluminum alloys averages 1800 kg/cm^2 with a standard deviation of 200 kg/cm^2 . If the distribution is normal what percentage of the alloys will have **06**

(a) tensile strength less than 1450 kg/cm^2

(b) tensile strength more than 1950 kg/cm^2

If specification limits are 1700 ± 500 how many components are meeting the customers need? Suggest the remedial action.

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857

- (b) Explain the following terms:

1. Cost of prevention
2. Cost of Appraisal
3. Muda
