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GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, June – 2021

(Sixth Semester)

BMEPE 6040 – QUALITY CONTROL AND RELIABILITY

(Mechanical Engineering)

Time: 2 hrs Maximum: 50 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) (1 x 10 = 10 Marks)

Q.1. Answer ***ALL*** questions [CO#] [PO#]

a. A process maintains six-sigma process capability. If the process mean shifts by as much as 1.5 standard deviation from the centre, the proportion of nonconforming produced is _____.

(i) 6 ppm (ii) 3.4 ppm

(iii) 1350 ppm (iv) 2700 ppm

b. Quality trilogy that focusses on universal way of thinking of quality was proposed by _____.

(i) Joseph M. Juran (ii) Philip B. Crosby

(iii) W. Edwards Deming (iv) Kouru Ishikawa

c. The process response converted into S/N ratio is always _____.

(i) Minimized (ii) Maximized

(iii) Set to zero (iv) Set to non-zero value

d. Which one of these is a dimension of quality?

(i) Hazard rate (ii) Process capability

(iii) Control limits (iv) Performance

e. Quality characteristics are classified into variables and _____.

(i) Attributes (ii) Standards

(iii) Specifications (iv) Constants

f. In fraction nonconforming control charts, the control limits may vary due to _____.

(i) Sample size (ii) Number of nonconforming units in a sample

(iii) Binomial distribution of occurrence of number nonconforming units in a sample (iv) Normal approximation of Binomial distribution

g. The consumer's risk means the probability that the consumer will _____.

(i) Accept a bad lot (ii) Accept a good lot

(iii) Reject a bad lot (iv) Accept a bad lot

h. In double sampling plan, decision is made based on _____.

(i) First sample only (ii) Two units from the first and second sample

(iii) A sample from the first lot and another sample from the last lot (iv) Either from the first sample or the combined nonconforming units in both the samples

i. It is desirable to have C_p value _____.

(i) greater than or equal to one (ii) smaller than one

(iii) greater than equal to two (iv) smaller than two

j. _____ distribution is used to model the time to failure of products that have a varying failure rate.

(i) Binomial (ii) Exponential

(iii) Weibull (iv) Poisson

PART – B **(2 x 5 = 10 Marks)**

Q.2. Answer ***ALL*** questions	[CO#]	[PO#]
a. Explain Quality Function Deployment (QFD).	1	1
b. What do you mean by Average Total Inspection (ATI)?	1	1
c. What do you mean by Juran's quality triology?	2	1
d. What is a continuous sampling plan?	3	1
e. Explain redundant and standby systems?	4	1

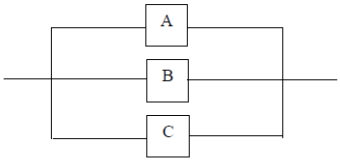
PART – C: (Long Answer Questions) **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions	Marks	[CO#]	[PO#]
3. Control charts for $\bar{x}$ and R are maintained on a quality characteristic. The sample size is n = 6. After 30 samples, we obtain, $\sum_{i=1}^{30} \bar{x}_i = 6000$ and $\sum_{i=1}^{30} R_i = 150$ Find the three-sigma limits for the $\bar{x}$ and R chart. Assume that both charts exhibit control. If the specifications are 200±5, what are your conclusion regarding process capability?	(6)	1	2
4. A process is being controlled with a fraction nonconforming chart. The process average has been shown to be 0.07. Three-sigma control limits are used and the procedure calls for taking daily samples of 400 items. (a) Calculate the upper and lower control limits (b) if the process average shifts to 0.10, what is the probability that the shift would be detected on the first subsequent sample? (c) What is the probability that the shift would be detected on the first or second sample taken after the shift?	(6)	1	2
5. Samples of n=6 items are taken from a manufacturing process at regular intervals. A normally distributed quality characteristic is measured and $\bar{x}$ and S values are calculated for each sample. After 50 subgroups have been analysed, we have $\sum_{i=1}^{50} \bar{x}_i = 1000$ and $\sum_{i=1}^{50} S_i = 75$ Compute the control limits for $\bar{x}$ and S charts. If the specification limits are 19 ± 4, what is your conclusion regarding the ability of the process?	(6)	2	2
6. The following data represent the number of nonconformities per 100 m^2 of fabric from a textile mill. Construct a c-chart for the number of nonconformities.	(6)	2	2

Sample Number	Number of Nonconformities	Sample Number	Number of Nonconformities
1	5	14	11
2	4	15	9
3	7	16	5
4	6	17	7
5	8	18	6
6	5	19	10
7	6	20	8
8	5	21	9
9	16	22	9
10	10	23	7
11	9	25	5
12	7	25	7
13	8		

7. Discuss Taguchi's philosophy for quality improvement. Discuss his loss function and its contribution. (6) 3 1

8. Three components A, B and C are placed in parallel to make a subassembly in a circuit board. Determine the system reliability for 2000 h of operation and find the mean time to failure. Assume that all three components have an identical time-to-failure distribution that is exponential with a constant failure rate of 0.0005/h. What is the mean time to failure of each component? If it is desired for the system to have a mean to failure of 4000 h, what should the mean time to failure be for each component? (6) 3 2



9. A sample of 12 electronic components is tested for 1000 h with no replacement of failed components. The time to failure is exponentially distributed. Three components failed within the prescribed test time, the failure times being 650, 680 and 720 h. Estimate the mean time to failure and the failure rate. Find a 90% confidence interval for the mean time to failure. (6) 4 2

10. Distinguish between single level and multilevel sampling plans for continuous production. (6) 4 1

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