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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Industrial Engineering and Management **Duration: 3 hrs.**
Course Code: 22IM5PCQAR **Max Marks: 100**
Course: Quality Assurance & Reliability

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Explain briefly various dimensions of quality.	*CO1*	PO1	**08**
	b)	What are the four main categories of quality costs? Give examples of costs that are associated with four main categories of listing them under the four main heads of quality costs. Discuss these items of costs and their influences on the overall productivity and quality aspects in the organization.	*CO1*	PO1	**08**
	c)	How does design of experiments help in improving customer expectations of quality.	*CO1*	PO1	**04**
		OR			
2	a)	The costs under individual categories are expressed as percentages of the TQC, giving the distribution of the total cost among the four categories. Such a distribution usually reveals information on what is happening within the quality system. The following two examples illustrate the idea:	CO2	PO1 PO4	**08**

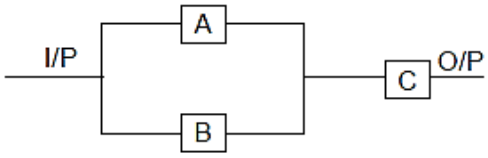
	Example 1	Example 2
Prevention	3%	4%
Appraisal	20%	87%
Internal Failure	9%	9%
External Failure	68%	0%
Total	100%	100%

Analyze above the data and give your inference in detail.

	b)	Explain with a neat sketch Juran's Quality Triology.	CO1	PO1	**08**

		c)	How does Quality Function Deployment as a tool help in managing customer expectations of quality? Give an example to illustrate.	CO1	PO1	**04**
			UNIT - II			
	3	a)	Explain the principles of quality audit program. Discuss ISO 9000 series of standards.	*CO2*	*PO1* *PO4*	**08**
		b)	What are chance and assignable causes of variability? What part they play in the operation and interpretation of Shewart control chart?	*CO2*	*PO1* *PO4*	**06**
		c)	Explain different types of field complaints	*CO1*	-	**06**
			OR			
	4	a)	Explain the principles of rational sub grouping.	*CO2*	*PO1*	**04**
		b)	Explain with a suitable example of analysis of typical control chart patterns. Support the answer with neat diagram.	*CO2*	*PO2*	**06**
		c)	Indicate the usage and significance of seven QC tools with an example. Support the answer with neat diagram.	*CO3*	*PO2*	**10**
			UNIT - III			
	5	a)	Subgroup of 4 items each are taken from a manufacturing process at regular intervals. Å certain quality characteristic is measured and $\bar{X}$, R values are computed for each subgroup. After 25 subgroup. $\Sigma \bar{X}$ = 15350, ΣR = 411.4. i. Compute the control limits for $\bar{X}$, R chart. ii. Assume all the points are falling within the control limits on both the charts. The specification limits are 610 ± 15. If the quality characteristic is normally distributed what percentage of product would fail to meet the specifications. iii. Any product that falls below L will be scrapped and above U must be reworked. It is suggested that the process can be centered at a level so that not more than 0.1% of the product will be scrapped. What should be the aimed value of $\bar{X}^{1}$ to make the scrap exactly 0.1%. iv. What percentage of rework can be expected with this centering?	*CO2*	*PO1* *PO4*	**12**
		b)	Samples of size n = 5 are collected from a process every half hour. After 50 samples have been collected, we calculate $\bar{\bar{X}} = 20$ and $\bar{S} = 1.5$. assume that both charts exhibit control and that the quality characteristic is normally distributed. i. Estimate the process standard deviation ii. Find the control limits on the $\bar{X}$ and S charts iii. If the process mean shifts to 22, what is the probability of concluding that the process is still in control?	*CO2*	*PO1* *PO4*	**08**
			OR			

	6	a)	The following are the inspection results of 20 lots of magnets. Each lot being 750. The no. of defective magnets are given below. **S.G. No. / Defects (d) / S.G. No. / Defects (d)** 1 / 48 / 11 / 47 2 / 83 / 12 / 50 3 / 70 / 13 / 47 4 / 85 / 14 / 57 5 / 45 / 15 / 51 6 / 56 / 16 / 71 7 / 48 / 17 / 53 8 / 67 / 18 / 34 9 / 37 / 19 / 29 10 / 52 / 20 / 30 Construct a suitable chart and state whether the process is in control or not.	*CO2*	*PO1* *PO4*	**12**
		b)	A textile manufacturer initiates the use of C-chart to monitor the no. of imperfections found in a bale of cloth. Each is of same length, width and fiber composition. A total 191 imperfections were found in the last 25 bales inspected. The four highest and lowest counts were as follows. Highest: 24, 19, 14, 12 Lowest: 4, 4, 5, 5 i. Calculate the 3σ control limits ii. Is the process in control iii. If not, what aimed value of C1 and control limits would you suggest for the future period.	*CO4*	*PO1* *PO4*	**08**
			UNIT - IV			
	7	a)	A single sampling plan is as follows: N = 5000; n = 80; c = 2 i. Plot the O.C. curve for the above plan ii. What is the producer's risk if AQL is 1.5%? iii. What is the consumer's risk if LTPD is 4.5%? iv. What is the ATI of the above plan at 1.25% defective of the incoming lot? v. Plot the AOQ curve and determine the AOQL.	*CO3*	*PO2*	**12**
		b)	Give the Comparison between 100% inspection and sampling inspection.	*CO1*	-	**04**
		c)	With the neat block diagram explain double sampling plan.	*CO1*	-	**04**
			OR			
	8	a)	Suppose that a single-sampling plan with n = 150 and c = 2 is being used for receiving inspection where the supplier ships the product in lots of size N = 3000. i) Draw the OC curve for this plan. ii) Draw the AOQ curve and find the AOQL. iii) Draw the ATI curve for this plan.	CO4	PO5 PO9	**12**

		b)	Define the following terms clearly with suitable illustrations i) Average outgoing quality limit. ii) Average sample number. iii) Average total inspection. iv) Lot tolerance percent defective (LTPD).	CO4	PO5 PO9	**08**
			UNIT - V			
	9	a)	An electronic system consists of 5 subsystems with the following MTBF: SS_A = 12500 SS_C = 11000 SS_E = 15550 SS_B = 2830 SS_D = 9850 These 5 SS are arranged in series configuration. What is the probability of survival for an operating period of 800 hrs?	*CO4*	*PO5* *PO9*	**07**
		b)	A system consists of 3 components A, B and C. The configuration of the system and the reliabilities of the elements are given below. Calculate the reliability of system R_A = 0.8 ; R_B = 0.7 ; R_C = 0.9. 	*CO4*	*PO5* *PO9*	**05**
		c)	Explain briefly failure rate curve and causes for each period.	*CO4*	*PO5*	**08**
			OR			
	10	a)	Given that a particular component has a constant failure rate and failures follows an exponential destination with λ =0.0005 failures per hour, Determine the reliability of the component for (i) t =10 hours (ii) t = 20 hours (iii) t = 50 hours (iv) t=1000 hours (v) t = 10,000 hours. Plot the time versus reliability graph and draw inferences on the plot that you have obtained.	CO4	PO5 PO9	**12**
		b)	Write the objectives of Life testing.	CO1	PO1	**04**
		c)	Define i) Reliability ii) MTBF	CO1	PO1	**04**

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