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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 & Management **Duration: 3 hrs.**

Course Code: 23IM5PCQAR **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)		"The two philosophies of Quality of Design and Quality of conformance are necessary to achieve the targets of Quality of product and process" Explain this with help of an example.	*CO2*	*PO1*	**10**
	b)		Give at least two definitions of Quality. What are the eight dimensions of Quality? Elaborate on how these dimensions determine the Quality of product taking a case example.	*CO2*	*PO1*	**10**
			OR			
2	a)		What are the fundamental concepts related to Quality audit? Why are Quality audits necessary parts of Quality assurance programs? How will you go about planning and performing the Quality audit activities? Discuss in brief detail.	*CO2*	*PO1*	**10**
	b)		What does ISO stand for? Discuss the important clauses of ISO 9001 standards. What are the benefits of ISO standards?	*CO2*	*PO1*	**10**
			UNIT - II			
3	a)		Sample of size n=5 is taken from a manufacturing process every hour. A Quality characterize is measured and $\bar{x}$ and R chart are computed for each sample after 25 samples have been analyzed be we have $\sum \bar{x}_i$=662.50 for i=1 to25 $\sum$Ri=9.00 for i=1 to 25 The Quality characteristic is normally distributed i) Find the control limits for the Xbar and R charts ii) Assume that both charts exhibit control, the specifications are 26.40 ± 0.50, estimate the fraction nonconforming iii) If the mean of the process were 26.40 what fraction nonconforming would result?	*CO3*	*PO2*	**12**
	b)		Discuss the following patterns exhibited on a control chart. i. Upward Trend ii. Downward Trend iii. Run of 7 or more successive points. iv. Cycle.	*CO3*	*PO2*	**08**

			OR			
	4	a)	Control charts for X bar and R are maintained on the resets strength of a metal fastener. After 30 samples of size n=6 are analyzed we find that $\sum \bar{x}$=12870 for i=1 to 30 $\sum R_i$=1350 for i=1 to 30 i. Compute control limits for $\bar{x}$ and R Chart. ii. Assuming that the R chart is in control, estimate the process mean and standard deviation. iii. If the process output is normally distributed and if specifications are 440±40, can the process meet the specifications? If not Estimate the fraction nonconforming iv. If the variance remains constant where should the mean be located to minimize the fraction nonconforming?	*CO3*	*PO3*	**12**
		b)	Differentiate between specification limits and control limits. Define process capability. Is it required that the manufacturing process must be stable and repeatable and must be "in control" for estimating the process capability? Why?	*CO3*	*PO2*	**08**
			UNIT - III			
	5	a)	A process is controlled with a fraction nonconforming control chart with three sigma limits n=100 UCL=0.161 center line =0.080 and LCL=0 i. Find the equivalent control chart for the number nonconforming. ii. Use the Poisson approximation to the binomial to find the probability of type I error. iii. Use the correct approximation to find the probability of a type II error if the process fraction non-conforming shifts to 0.2. iv. What is the probability of detecting the shift as in pasty (iii) above by at most the fourth sample after the shift?	*CO3*	*PO2*	**12**
		b)	Bring out the distinction between p chart and np chart. When do you prefer to use p chart in preference to np charts? What is the interpretation when a point falls below the lower control chart in a P chart.	*CO2*	*PO1*	**08**
			OR			
	6	a)	A control chart is to be established on a process producing refrigerators. The inspection unit is one refrigerator and chart for non-conformities is to be used. As preliminary data 16 non conformities were counted in inspecting 30 refrigerators. i. Compare the three sigma control limits for appropriate control chart?	*CO3*	*PO2*	**10**
		b)	What is a defect? Give an example of defect with respect to the following process (i) Casting (ii) Machining (iii) Injection moulding (Illustrative sketch to be given to show the defects in part or components)	*CO2*	*PO1*	**10**

			UNIT - IV			
	7	a)	Suppose that a product is shipped in lots of size N= 5000. The receiving inspection procedure used is single sampling with n=50 and c=1 i. Draw the type A of OC curve for this plan ii. Draw the type B OC curve for this plan and compare it to the type A OC curve found in part (i) above. iii. Which curve is appropriate for this situation?	*CO3*	*PO2*	**12**
		b)	Clearly explain the following (also show illustratively) i. Producer's risk. ii. Lot tolerance percent defective iii. Average outgoing quality level iv. Consumers risk.	*CO2*	*PO1*	**08**
			OR			
	8	a)	A company is manufacturing electronic components, and they need to ensure their quality meets certain standards. They decide to use a double sampling plan to inspect a batch of 2000 components. The acceptance criteria are as follows: First Sample Size (n_1): 150 components. Second Sample Size (n_2): 200 components Acceptance Number for First Sample C_1 =5 Acceptance Number for Second Sample (c_2= 7 From the first sample of 150 components, 4 defective components are found. Should the lot be accepted, rejected, or should a second sample be taken? If a second sample is taken and among the 200 components inspected, 3 more defective components are found, what should be the final decision? Use the acceptance criteria provided to justify your answer.	*CO3*	*PO2*	**12**
		b)	Distinguish between Acceptance Rectification plan and Acceptance Rejection Plans. Show the schema related to both these plans.	*CO2*	*PO1*	**08**
			UNIT - V			
	9	a)	Illustrate the common failure rate curve (Bath tub curve). Discuss the causes of failures in each of the regions of the bath tub curve.	*CO2*	*PO1*	**08**
		b)	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 comment on the plot that you have obtained.	*CO3*	*PO2*	**12**
			OR			
	10	a)	A component has an exponential failure distribution with a mean time to failure (MTTF) of 500 hours. i. Calculate the failure rate (λ\lambda). ii. What is the probability that the component will fail	*CO3*	*PO2*	**10**

			within the first 200 hours? iii. What is the probability that the component will operate without failure for at least 300 hours?			
		b)	Define and explain the following key concepts of reliability: i. Mean Time to Failure (MTTF) ii. Mean Time Between Failures (MTBF) iii. Failure Rate (λ\lambda) iv. Reliability Function (R(t)) v. Hazard Function (h(t))	*CO2*	*PO1*	**10**

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