U.S.N.										

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

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Industrial Engineering & Management **Duration: 3 hrs.**
Course Code: 20IM5DCQAR **Max Marks: 100**
Course: Quality Assurance and Reliability

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

UNIT - I

1 a) Give at least two definitions of Quality. What are the eight dimensions of Quality? Elaborate on how these dimensions determine the Quality of this product taking a case example. **10**

b) Clearly bring out the distinction between Traditional Quality methodologies and the Modern approaches to building Quality into the product at the design stage itself. Trace the evolution of the Quality movement and highlight the contribution of the Quality gurus along with their techniques that they have proposed. **10**

UNIT - II

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. **10**

b) What does ISO stand for? Discuss the important clauses of ISO 9001 standards. What are the benefits of ISO standards? **10**

OR

3 a) Distinguish between chance causes and assignable causes by considering the machining of a component on a CNC turning centre as a process operation example. How will this distinction help you in achieving Quality targets and managing the process using statistical process control? Outline the Basic principles of control charts. **10**

b) 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? List out the seven QC tools along with an illustrative sketch to represent each tool. **10**

UNIT - III

4 Samples of n = 6 items each are taken from a process at regular intervals. A quality characteristic is measured, and Xbar and R values are calculated for each sample. After 50 samples, we have $\sum_1^{50} Xbar = 2000$ and $\sum_1^{50} R = 200$ **20**

Assume that the quality characteristic is normally distributed.
(i) Compute control limits for the Xbar and R control charts.

(ii) All points on both control charts fall between the control limits computed in part (ii). What are the natural tolerance limits of the process?
(iii) If the specification limits are 41 ± 5.0, what are your conclusions regarding the ability of the process to produce items within these specifications?
(iv) Assuming that if an item exceeds the upper specification limit it can be reworked and if it is below the lower specification limit it must be scrapped, what percent scrap and rework is the process producing?
(v) Make suggestions as to how the process performance could be improved.
(You are required to diagrammatically depict all the limits that you have computed and use this to develop your answers)

OR

5 a) A process that produces titanium forgings for automobile turbocharger wheels is to be controlled through use of a fraction nonconforming chart. Initially, one sample of size 150 is taken each day for twenty days, and the results shown in Table below are observed. **10**
(i) Establish a control chart to monitor future production.
(ii) What is the smallest sample size that could be used for this process and still give a positive lower control limit on the chart?

Day	Nonconforming Units	Day	Nonconforming Units
1	3	11	2
2	2	12	4
3	4	13	1
4	2	14	3
5	5	15	6
6	2	16	0
7	1	17	1
8	2	18	2
9	0	19	3
10	5	20	2

b) An automobile manufacturer wishes to control the number of nonconformities in a subassembly area producing manual transmissions. The inspection unit is defined as four transmissions, and data from sixteen samples (each of size 4) are shown in Table below. **10**

Sample Number	Number of Nonconformities	Sample Number	Number of Nonconformities
1	1	9	2
2	3	10	1
3	2	11	0
4	1	12	2
5	0	13	1
6	2	14	1
7	1	15	2
8	5	16	3

(i) Set up a control chart for nonconformities per unit.
(ii) Do these data come from a controlled process? If not, assume that assignable causes can be found for all out-of-control points and calculate the revised control chart parameters.
(iii) Suppose the inspection unit is redefined as eight transmissions. Design an appropriate control chart for monitoring future production

UNIT - IV

6 a) Bring out the differences between 100% inspection and Sampling inspection. **04**

b) Define the following terms clearly **04**

i. AQL
ii. LTPD
iii. Producer's risk
iv. Consumer's risk

c) 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. **12**
(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.

UNIT - V

7 a) Discuss few of the common failure models of components. Sketch the Time versus Failure rate and failure density curves, for an exponentially distributed time to failure model. Also sketch the time versus Reliability curve for exponential failure model. **08**

b) A regulated power supply consists of a step down transformer, rectifier, filter and a regulator. The constant failure rates of these components are: **12**
Transformer 1.56% failures/1000 hours
Rectifier 2.00% failures/1000 hours
Filter 1 .70% failures/1000 hours
Regulator 1 .40% failures/1000 hours
Determine the reliability of this supply if it is required to operate for (1) 500 hours (2) 1000 hours (3) 1500 hours.
Comment on reliability vs. hours of operation.
What is the failure rate of total supply unit?

******