MSc.Eng/PhD (MPE) 3 October 2023 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid-Semester Examination — Summer Semester, A.Y. 2022-2023
Course No. MCE 6221 — Time : 1½ hours
Course Title: Quality Assurance and Management — Full Marks : 75

There are 4 (FOUR) Questions. Answer any 3 (THREE) of them.
Use the graph paper wherever necessary. Marks in the Margin indicate the full marks.

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1. a) Stating the basic *principles* and *standards* regarding quality products and services, justify that quality assurance and management is a *necessary commitment* of every well-educated Muslims. Write with due references. 7

   b) An engineer measures and observes several responses for a variable of interest. The average of these recorded measurements is exactly what the engineer desires for any single response. Why should the engineer be concerned about measurement variability in this context? How does the engineer's concern relate to quality? Please think and explain. 8

   c) What is the difference between *quality conformance* and *quality performance*? Explain with examples. 5

   d) What is a *critical-to-quality* (CTQ) characteristic? Name any engineering product and point out the types of CTQ characteristics that should be possessed by the product. 7

2. a) Explain Customer's *experience* of quality and Producer's *creation* of quality through a process. Give examples. 6

   b) State and discuss *two hypotheses* about customers. Give wise/convincing answer. 5

   c) You know the acronym of PDCA/PDSA. Show its step and relate the basic and advanced quality management tools *in a table* (column for PDSA and row for tools and techniques). Use tick marks on the table. 7

   d) When carrying out data collection and collation, you noticed that you have received this data: – Fault 1 – 85 occurrences; Fault 2 – 125 occurrences; Fault 3 – 28 occurrences; Fault 4 – 395 occurrences; Fault 5 – 185 occurrences; Fault 6 – 128 occurrences; Fault 7 – 85 occurrences; Fault 8 – 169 occurrences; Fault 9 – 148 occurrences; Fault 10 – 209 occurrences. What is the best tool/technique to show this data for root cause analysis? Construct it. 7

3 a) Give a clear description why control charts are sometimes divided into *zones* with at least five zonal rules for using variable control charts. 5

   b) What are different *variable control charts* necessary to depict data and when and why pair of control charts are used? Give scientific reasons. 7

   c) Explain the significance of *subgroup size* in variable control charts. What are the design factors you need to consider for constructing a representative variable control chart? 7

   d) Name some control chart constants. What is the significance of control chart constants? Show some constants in computing the $\bar{X}$-bar control limits when standards are given, and retrospective data are used. 6

4 a) What practical implication in terms of process operation do the type I and type II errors have? Illustrate by using the necessary diagrams. 5

b) A computer monitor is produced by a company. The company has chosen the inspection unit is one monitor for constructing a common chart for nonconformities. As the preliminary data was obtained, 20 nonconformities were counted in inspecting 30 monitors. 10

i. What is the appropriate control chart for the case?
ii. What are the 3-sigma control limits? How it is different from 6-sigma limits?
iii. What is the α-risk for 3-sigma control chart?
iv. What is the β-risk if the average number of defects is two?

c) Suppose a company is producing 100s of lots every month. It received some complaints from its customers. The company employed you to apply some scientific quality management techniques to minimize complaints and develop a good relationship. Are you going to apply acceptance sampling technique? Why or why not? How are you going to apply for it? What information can you show in an operating characteristic curve? How is it affected by sample size and acceptance number? 10

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