K. K. Wagh Institute of Engineering Education and Research, Nashik

(An Autonomous Institute from A. Y. 2022-23)

Marking Scheme

End-Sem Examination, Winter 2025

Academic Year:2025-2026 **Semester:III**

Name of Programme:MBA **Pattern:2024**

Name of Course:Lean Six Sigma **Course Code:2410614D**

Q. No.	Details	Max. Marks	CO No.	BT Level
Q.1	Unit 1 (6 marks) **Apply** the DMAIC methodology to improve a process with high defect rates in a manufacturing organization. (1 mark for each step)	[6]	CO1	L1
Q.2	Unit 2(6 marks) A team has a DPMO of **20,000**. They inspect **2,000 units**, with each unit having **4 opportunities**.Calculate how many total defects occurred? (2 marks each step)	[6]	CO2	L2
Q.3	a)What is Process Capability Index?A machining process produces shafts with a **specification limit** of:**LSL= 48 mm, USL = 52 mm.**From process data, the following statistics are obtained:**Process mean (μ) = 50.5 mm.Process standard deviation (σ) = 0.5 mm.**Calculate(Cp), (Cpk)and Comment on the process capability and centering. (8 marks),(2 marks for each answer) OR b)What is Process Capability Index?A machining process produces shafts with a **specification limit** of: **LSL= 95 mm, USL = 105 mm.**From process data, the following statistics are obtained:**Process mean (μ) = 102 mm.Process standard deviation (σ) = 1.5 mm.**Calculate(Cp), (Cpk)and Comment on the process capability. (8 marks),(2 marks for each answer)	[16] 8+8 Or 10+6	CO3	L3
	c)Analyse and write in detail the key steps in Process Analysis (8 marks),(1.5 marks for each step) **OR** d)Analyse the given below tools used in process analysis with a diagram and example 1)Value Stream Mapping 2)Histogram		CO3	L3

	(8 marks) ,(4marks for each)			
Q.4	a) A teacher wants to check whether **different teaching methods** affect students' **test scores**.**Method 1:**Lecture,**Method 2:** Group discussion,**Method 3:** Online learning.The teacher tests **4 students per method** after a month.Apply ANOVA to interpret the results. Given value of alpha is 0.05 **Method** **Student 1** **Student 2** **Student 3** **Student 4** Lecture 70 75 72 68 Group Discussion 78 82 85 80 Online Learning 88 85 90 92 (8 marks),(1.5 marks each step) **OR** b) A teacher wants to check the effectiveness of three study methods on test scores.Apply ANOVA to interpret the results.Given value of alpha is 0.05 **Group** **SCORES** Group A 70,75,80 Group B 85,90,88 Group C 72,78,74 (8 marks),(1.5 marks each step)	[16] 8+8 Or 10+ 6	CO4	L4
	c)A machine fills sugar packets with a claimed mean of 500 g. The population standard deviation is known to be 8 g. A sample of 40 packets has a mean weight of 497.5 g. Test at **5% significance** if the machine is underfilling..(Zcritical from table is -1.645) (8 marks),(2marks for each step) **OR** d)A sample of 16 batteries has mean life 40 hours and standard deviation 6 hours. Test at 1% significance whether the population mean life is **different from 44 hours**..(value of tcritical from table is +_2.947) (8 marks),(2 marks for each step)		CO4	L4

Q.5	a)**Evaluate** the effectiveness of $\bar{X}$–R charts versus p-charts in monitoring a manufacturing process, and justify which is better under different circumstances. (8 marks), (4 marks for each chart) **OR** b)Compare and evaluate the effectiveness of different types of control charts ($\bar{X}$–R, p-chart, c-chart) in reducing defects in a production environment. (8 marks), (2.5 marks for each type)	[16] 8+8 Or 10+ 6	CO5	L5
	c)A process manufactures bolts. Every hour, a **sample of 4 bolts** is taken and their **lengths (mm)** are measured. SPC Constants (for sample size n = 4)$A_2 = 0.729, D_3 = 0,$ $D_4 = 2.282$.Apply SPC to find if the process is under control **Sample** **Measurements (mm)** 1 50, 51, 49, 50 2 50, 50, 51, 49 3 51, 50, 50, 51 4 49, 50, 50, 49 (8 marks) (2 mark for each step) OR d) A process produces shafts. Every hour, a sample of 4 shafts is taken and their diameters (mm) are measured. SPC Constants (for sample size n = 4)$A_2 = 0.729, D_3 = 0,$ $D_4 = 2.282$.Apply SPC to find if the process is under control **Sample** **Measurements (mm)** 1 20, 21, 19, 20 2 20, 20, 21, 19 3 21, 20, 20, 21 4 19, 20, 20, 19 (8 marks) , (2 mark for each point)		CO5	L5