Set 2

SRM Institute of Science and Technology

College of Engineering and Technology

B.Tech - Mechanical Engineering

Academic Year: 2022-23 Even Semester: VI Mark: 50

Subject Code: 18MEO113T Title: Design of Experiments Duration: 90 min

Type of Test: CLAII

Q. No.	Part A Question	M	BL	CO	PO
1	It is advisable to ensure that the measurement system is capable, stable, robust and _____ to environmental changes. (A) Sensitive (B) Insensitive (C) Scalable (D) Usable	1	1	2	1
2	In _____ plots, inactive main and interaction effects tend to fall roughly along a straight line. (A) Cube (B) Normal Probability for residuals (C) Pareto (D) Normal Probability for factors	1	2	2	1
3	If a line is considered as best regression line, the _____ should be minimal. (A) Sum of squares of error (B) Square of error (C) Sum of error (D) Error	1	2	2	1
4	From the experiments, we got the results as follows: 53.48; 52.69; 53.88; 54.12; 54.36. What is the Standard deviation? (A) 53.706 (B) 0.428 (C) 1.713 (D) 0.654	1	2	2	2
5	In Resolution III design, _____ effects are aliased with any other main effect, but main effects are confounded with two-factor interactions. (A) Main (B) Interaction (C) Mixed (D) Anti-aliased	1	2	2	2
6	The Taguchi approach is most closely associated with: (A) Total quality management (B) Standardization (C) Robust design (D) Quality function deployment	1	1	3	1
7	Japanese quality guru who developed new concepts in response to the American gurus	1	1	3	1

	(A) Walter Shewhart (B) Philip Crosby (C) Genichi Taguchi (D) Shuji Nakamura				
8	What is the quality loss function for smaller-the-better conditions? (A) $L(y) = ky^2$ (B) $L(y) = k(1/y^2)$ (C) $L(y) = k/\Delta^2$ (D) $L(y) = km^2$	1	1	3	1
9	Under this condition, the Loss is A_0 if the quality characteristics are above the upper limit Δ. (A) Smaller-the-better (B) Larger-the-better (C) Nominal-the-best (D) No loss	1	2	3	1
10	_____ is delivered if a product or service tangible performs its intended function throughout its projected life under reasonable operating conditions without harmful side effects. (A) Interchangeability (B) Selective assembly (C) Taguchi quality function (D) Ideal quality	1	1	3	1
	Part B Question				
	Answer any two				
11	Explain the Pareto plot with an example.	4	2	2	2
12	Explain the Normal Probability Plot for residuals.	4	2	2	2
13	List eight factorial design types.	4	2	2	1
	Answer any two				
14	Explain, with an example, how the Taguchi method is quite different from conventional methods followed in the industry.	4	2	3	2
15	Explain the Interchangeability concept with an example.	4	2	3	1
16	List 8-steps followed in Taguchi Methodology	4	2	3	1
	Part C Question (Unit 2)				
17	Explain the following plots in detail: i. Main effects plots ii. Interactions plots iii. Cube plots iv. Pareto plots for factor effects v. Normal probability plot for factor effects vi. Normal probability plot for residuals	12	3	2	3
	or				
18	An experimenter wants to know the effect of agriculture spray and stimulants on growth. The spray has two levels 50 and 100 ml. The stimulants also have two levels, 35 and 70 grams. The experiment was repeated in three trials. The experimenter wants to know if adjustments to	12	4	2	3

	either agriculture spray or stimulants would increase the growth. Factors: Spray / Stimulants; Trails: I / II / III 50 / 35 / 27 / 28 / 25 100 / 35 / 32 / 32 / 36 50 / 70 / 23 / 18 / 19 100 / 70 / 30 / 29 / 31				
	Part C Question (Unit 3)				
19	The objective of the research is an experimental investigation to find the optimization of machining parameters of EDM machine for machining steel material EN-8 using Taguchi's DOE. Ra values obtained according to the experiment sequence are: 2.625; 1.905; 2.5275; 2.99; 4.4325; 4.10; 3.38; 3.015; 3.312. Find the Main effect, draw the factor effect diagram, and identify the optimum process parameters. **Column** / **Factors** / **Units** / **Level -1** / **Level -2** / **Level -3** 1 / Peak current / Amps / 3 / 5 / 7 2 / Pulse on time / µ-sec / 25 / 52 / 100 3 / Gap voltage / Volts / 45 / 50 / 55 4 / Fluid pressure / Kg /cm^2 / 0.5 / 0.75 / 1.0	12	4	3	3
	or				
20	Determine which process parameters have the greatest impact on the hardness of the steel components. Hardness values (HV) are 57; 59; 65; 45; 67; 73; 51; 48. Parameter number / Parameters / Level 1 / Level 2 1 / Temperature(^{O}C) / 760 / 900 2 / Quenching rate(^{O}C/s) / 35 / 140 3 / Cooling time(sec) / 1 / 300 4 / Carbon contents (Wt% c) / 1 / 6 5 / Co $_2$concentration (%) / 5 / 20	12	4	3	3