

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	In many organisations, managers encourage their engineers to use the so-called home-grown solutions, which are consistent with the _____ approach, for process and quality-related problems. (A) Best guess (B) OVAT approach (C) Several Factors, one at a time (D) Several factors, all at the same time	1	2	2	1
2	_____ plots display the average response values at all combinations of process or design parameter settings. (A) Cube (B) Normal Probability for residuals (C) Pareto (D) Normal Probability for factors	1	1	2	1
3	In the response contour plots, if the model contains interaction effects, the contour line will be _____. (A) Straight (B) Parallel (C) Curved (D) Non-parallel	1	1	2	1
4	Once the statistical analysis is performed on the experimental data, it is important to verify the results by means of confirmatory trials. What is the number of confirmatory runs at the optimal settings? (A) 1 to 5 runs (B) 2 to 10 runs (C) 3 to 15 runs (D) 4 to 20 runs	1	2	2	2
5	From the experiments, we got the results as follows: 53.48; 52.69; 53.88; 54.12; 54.36. What is the statistical confidence interval? (A) 53.48,52.69 (B) 54.55,52.83 (C) 54.12,54.36 (D) 53.88,53.48	1	2	2	2
6	It is the last step in Genichi Taguchi's method.	1	1	3	1

	(A) Parameter design (B) Tolerance design (C) System design (D) Quality design				
7	The loss is proportional to _____ of the value of the quality characteristics from the target value. (A) Deviation (B) Square of the deviation (C) Lower Specification Limit (D) Upper Specification Limit	1	2	3	1
8	How a quality can be quantified (A) Performance + expectations (B) Performance x expectations (C) Performance / expectations (D) Performance – expectations	1	2	3	2
9	In the larger-the-better loss function no loss if the quality characteristics is _____ the lower limit Δ . (A) Below (B) Above (C) Equal (D) Proportional	1	1	3	1
10	Under the following, which one of the disturbances is considered internal? (A) Wear and tear inside a specific unit (B) Variation in the environment where the product is used (C) Deviation from target values. (D) Variation between operators	1	1	3	1
	Part B Question				
	Answer any two (Unit 2)				
11	Briefly explain the barriers to the successful application of DOE.	4	2	2	1
12	Explain a simple linear regression model with all its parameters and diagram.	4	2	2	2
13	Explain a regression model for factors at 2 levels with all its parameters.	4	2	2	2
	Answer any two (Unit 3)				
14	Explain robust design.	4	2	3	1
15	Explain the three steps followed in robust design.	4	2	3	2
16	Explain the Taguchi Quality Loss Function.	4	2	3	1
	Part C Question (Unit 2)				
17	Explain the P-B design in detail with its advantages and disadvantages. And make an eight-run geometric P-B design.	12	4	2	2
	or				
18	Consider an investigation into the effect of the concentration of the reactant and the amount of the catalyst on the conversion (yield) in a chemical process the objective of the experiment was to determine if adjustments to either of these two factors would increase the yield. Let the reactant	12	4	2	3

	<p>concentration be factor A and the two interest levels be 15 and 25 percent. The catalyst is factor B, with the high level denoting 2 pounds of the catalyst and the low level denoting only 1 pound. The experiment is replicated three times, so there are 12 runs. The order in which the runs are made is random, so this is a completely randomized experiment.</p> <table><tr><th colspan="2">Factors</th><th colspan="3">Replicate</th></tr><tr><th>A</th><th>B</th><th>I</th><th>II</th><th>III</th></tr><tr><td>15</td><td>1</td><td>28</td><td>25</td><td>27</td></tr><tr><td>25</td><td>1</td><td>36</td><td>32</td><td>32</td></tr><tr><td>12</td><td>2</td><td>18</td><td>19</td><td>23</td></tr><tr><td>25</td><td>2</td><td>31</td><td>30</td><td>29</td></tr></table>	Factors		Replicate			A	B	I	II	III	15	1	28	25	27	25	1	36	32	32	12	2	18	19	23	25	2	31	30	29														
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19	<p>a. The critical dimension of a mechanical component made using a turning machine must be 0.45 ± 0.005 inches. The scrapping cost is 100 USD per component. Samples taken from the turning machine had the following dimensions: 0.451; 0.447; 0.448; 0.452; 0.450; 0.453; 0.449; 0.447; 0.454; 0.456; 0.450; 0.452.</p> <p>i. Find the Taguchi loss equation for this operation.</p> <p>ii. Determine the average loss function for the parts made using this turning machine.</p> <p>b. Explain Taguchi's quality loss function and its three types in detail.</p>	12	4	3	3																																								
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20	<p>The objective of the experiment is to obtain minimum surface roughness of the parts machined by wire-cut EDM machine using Taguchi's DOE technique of process parameters. Surface roughness (Ra) values were obtained using Taylor-Hobson Surtronic instruments, and the sequence are: 2.5275; 2.3520; 2.2540; 2.4650; 2.7000; 2.8125; 2.350; 2.2875. Find the Main effect, draw the factor effect diagram, and identify the optimum WEDM process parameters.</p> <table><tr><th>Column</th><th>Factors</th><th>Units</th><th>Level-1</th><th>Level-2</th></tr><tr><td>1</td><td>Pulse on time</td><td>μ - sec</td><td>125</td><td>130</td></tr><tr><td>2</td><td>Pulse off time</td><td>μ - sec</td><td>35</td><td>40</td></tr><tr><td>3</td><td>Peak current</td><td>Amps</td><td>11</td><td>12</td></tr><tr><td>4</td><td>Wire tension</td><td>Grams</td><td>1000</td><td>1200</td></tr><tr><td>5</td><td>Wire feed</td><td>M / min</td><td>7</td><td>8</td></tr><tr><td>6</td><td>Fluid rate</td><td>Lpm</td><td>8</td><td>9</td></tr><tr><td>7</td><td>Fluid pressure</td><td>Kg /cm²</td><td>13</td><td>15</td></tr></table>	Column	Factors	Units	Level-1	Level-2	1	Pulse on time	μ - sec	125	130	2	Pulse off time	μ - sec	35	40	3	Peak current	Amps	11	12	4	Wire tension	Grams	1000	1200	5	Wire feed	M / min	7	8	6	Fluid rate	Lpm	8	9	7	Fluid pressure	Kg /cm ²	13	15	12	4	3	3
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