Printed Page:- 03 **Subject Code:- AMTME0102**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech

SEM: I - CARRY OVER THEORY EXAMINATION - JUNE 2023

Subject: Design of Experiments

Time: 3 Hours **Max. Marks: 70**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION A **15**

1. Attempt all parts:-

1-a. Which of these is not an application of experimental design in the field of the Engineering design? (CO-1) 1

(a) Evaluation of key product design parameters that impact performance

(b) Evaluation and comparison of basic design configurations

(c) Evaluation of material alternatives

(d) None of these

1-b. According to the data given below, what is the value of the F statistic? (CO-2) 1

(a) 2

(b) 0.2

(c) 5

(d) Something else

1-c. In one-way ANOVA with total number of observations is 15 with 5 treatments then total degrees of freedom is 1

(a) 4

(b) 75

(c) 3

(d) 10

1-d. Read the following statements carefully. Mark the correct choice Statement 1: The DOE using Taguchi approach can economically satisfy the needs of problem solving and product/process design optimization projects. Statement 2: By learning and applying this technique, engineers, scientists, and researchers can significantly reduce the time required for experimental (CO-4) 1

(a) Only statement 1 is correct

(b) Only statement 2 is correct

(c) Statement 1 and 2 is correct

(d) none of the above

1-e. The uncontrollable factors are also called _____. (CO-5) 1

(a) Acceptance factors

(b) Designed factors

(c) Noise factors

(d) All the above

2. Attempt all parts:-

2.a. What is test? (CO-1) 2

2.b. What is meant by the terms: randomization and replication? (CO-2) 2

2.c. Why confounding design is required? (CO-3) 2

2.d. List any four types of noise factors. (CO-4) 2

2.e. What is Weighted S/N (WSN) ratio method? What are the steps to construct an orthogonal array? (CO-5) 2

SECTION B **20**

3. Answer any <u>five</u> of the following:-

3-a. What are the important considerations involved in design an experiment? (CO-1) 4

3-b. Describe the four ways of reducing the variation in production sample. (CO-1) 4

3-c. An experimenter has conducted a single-factor experiment with four levels of the factor, and each factor level has been replicated six times. The computed value of the F-statistic is F0= 3.26. Find the P-value. Indicate the sampling distribution of the F-statistic and the method or software utilized. (CO-2) 4

3-d. Explain the single factor design and confounding design with example .(CO-2) 4

3.e.	Explain the Cochran's Theorem. (CO-3)	4
3.f.	What are the optimization techniques available for manufacturing techniques involving multiple stages ? (CO-4)	4
3.g.	What is Parameter and tolerance design concepts? (CO-5)	4

SECTION C **35**

4. Answer any <u>one</u> of the following:-

4-a.	Suppose that you want to investigate the factors that potentially affect cooking rice. (a) What would you use as a response variable in this experiment? How would you measure the response? (CO-1)	7
4-b.	Explain the methord Sampling and Sampling Distributions with suitable example. (CO-1)	7

5. Answer any <u>one</u> of the following:-

5-a.	A study was conducted using a 2^2 factorial design with factors A, B and C. The data obtained are given in a below table Analyse the data assuming that each replicate (R_1 and R_2) as a block of one day. (CO-2)	7
5-b.	What is the significance of Standard Deviation Increase. (CO-2)	7

6. Answer any <u>one</u> of the following:-

6-a.	Write down the Normality Assumption. (CO-3)	7
6-b.	Explain the Plot of Residuals Versus Fitted Values. (CO-3)	7

7. Answer any <u>one</u> of the following:-

7-a.	Write a short note on JIT. (CO-4)	7
7-b.	How Taguchi is different from other method in experimental design. (CO-4)	7

8. Answer any <u>one</u> of the following:-

8-a.	State the additional experimental steps involved in robust design experimentation.(CO-5)	7
8-b.	An engineer wants to study the effect of the control factors A, B, C, D and E including the interactions AB and AC affecting the hardness of a metal component. The objective is to maximize the hardness. Design an OA experiment. (CO-5)	7