AHMEDABAD UNIVERSITY
School of Engineering and Applied Science
2025-2026 Monsoon

ENR709 Research Methodology in Engineering
End-Term Examination
1st December, 2025, Monday, 5.00 PM – 7.00 PM

Name:	Roll no.	A	U							Marks 50

Write your answers on the answer book. Answer all questions. Numbers on the right indicate marks for respective question. Assume suitable data wherever necessary and specify it clearly in your answers.

1. Answer the following questions (one mark each) *5 M*

1. Student collusion plagiarism involves copying content from existing literature. True or False.
2. When one takes content from the source without any attribution it is called _____.
3. Code plagiarism can be detected by Turnitin. True or false
4. What is the type of plagiarism when some ideas from a source are rephrased without attributing the source?
5. Manupulating the text from source content by misleading the plagiarism detection software is called _____.

2. A soft drink bottler is interested in obtaining more uniform fill heights in the bottles produced by his manufacturing process. The filling machine theoretically fills each bottle to the correct height bust in practice there is a variation around this target and the bottler would like to understand the sources of this variability better and eventually reduce it. A process engineer can control three variables during the filing process namely, the percentage carbonation (A) operating pressure in the filler (B) and bottles produced per minute or line speed (C). The pressure and speed are easy to control but percent carbonation is more difficult to control during actual manufacturing because it varies with product temperature. However, for purposes of an experiment the engineer can control carbonation at three levels: 10, 12 and 14%. She chooses two levels of pressure (25 and 30 psi) and two levels for line speed (200 and 250 bpm). She decides to run two replicates of a factorial design in these three factors with all 24 runs taken in random order. The response variable observed in a production run of the bottles at each set of conditions. The data that resulted from the experiement is shown in the Table below. Positive directions are fill heights below the targets while negative deviations are fill heights below the target. *25 M*

	Operating pressure (B)			
	25 psi		**30 psi**	
Percent Carbonation (A)	**Line speed (C)**		**Line speed (C)**	
	200	**250**	**200**	**250**
10	-3	-1	-1	1
	-1	0	0	1
12	0	2	2	6
	1	1	3	5
14	5	7	7	10
	4	6	9	11

Find: Sum of squares (Total); Sum of squares of Individual components A, B and C and interaction AB.

3. A chemical Engineer is interested in determining the operating conditions that maximize the yield of a process. The two controllable variables influence process yield namely the reaction time and the reaction temperature. The engineer is currently operating the process with a reaction time of 35 minutes and a temperature of 155 F which result in yields of around 40%. Because it is unlikely that this region contains the optimum she fits a first order model and applies method of steepest ascent. The process data for fitting first order model is as follows: *20 M*

Zeta1 is the time in minutes and Zeta2 is temperature in F. The coefficients of the model the response equation ($y=C+a_1x_1+a_2x_2$) obtained from multiple linear regression are $a_1=0.85$ and $a_2=0.305$ respectively.

Find the following:

Coded variables x_1 and x_2

Select the right step size for steepest ascent

Find the new values of Zeta1 and Zeta2 for 10 values

Zeta1	Zeta2	y
30	190	39.3
30	220	40
40	190	40.9
40	220	41.5
35	200	40.3
35	200	40.5
35	200	40.7
35	200	40.2
35	200	40.6