Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 09- 12-2025 **Time:** 01:00pm – 04:00pm

School: SOE	**Program:** B. Tech	
Course Code: MEC3008	**Course Name:** Design and Analysis of Experiments	
Semester: VII	**Max Marks**:100	50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	14	14	24	12	22	24

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Define null hypothesis.	**2 Marks**	**L1**	**CO1**
2.	Define Design of Experiments (DOE).	**2 Marks**	**L1**	**CO1**
3.	Differentiate between Population and sampling	**2 Marks**	**L1**	**CO2**
4.	Write the formula for mean of the sample and variance	**2 Marks**	**L1**	**CO2**
5.	Define Population with example	**2 Marks**	**L1**	**CO3**
6.	What is sampling?	**2 Marks**	**L1**	**CO3**
7.	What are quantitative and qualitative factors? Give one example each	**2 Marks**	**L1**	**CO4**
8.	What is a factorial design?	**2 Marks**	**L1**	**CO5**
9.	What is a block effect?	**2 Marks**	**L1**	**CO6**
10.	How many runs are needed for a 3-factor, 2-level factorial design?	**2 Marks**	**L1**	**CO6**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	With a neat sketch explaining normal distribution	**10Marks**	**L2**	**CO1**
	b.	Write a note on Hypothesis Testing	**10Marks**	**L2**	**CO2**
		Or			
12.	**a.**	Explain the confidence interval for difference in Two Means	**10 Marks**	**L2**	**CO1**
	b.	With a neat sketch explain standard normal distribution	**10Marks**	**L2**	**CO2**

13.	**a.**	Three fuel injection system are tested for efficiency and the following coded data are obtained do the data support the hypothesis that the systems offer equivalent levels of efficiency. System 1 / System 2 / System 3 48 / 60 / 57 56 / 56 / 55 46 / 53 / 52 45 / 60 / 50 50 / 51 / 51	**10 Marks**	**L3**	**CO3**
	b.	The length of life X of certain computers is approximately normally distributed with mean μ and standard deviation σ =40 hrs. If a random sample 30 computers has an average life of 788 hrs, test the null hypothesis that μ = 800 hrs against the alternative hypothesis at a)1% b)5% and c)10%level of significance.	**10Marks**	**L3**	**CO4**
		Or			

14.	**a.**	Three teaching methods were tested. Scores of students (out of10) under each method Group A :8,9,6,7 Group B:7,8,5,6 Group:6,7,4,5 Test a α = 0.05 whether the mean scores differ between the three groups [solve by using one-way ANNOVA]	**10 Marks**	**L3**	**CO3**
	b.	A chemical engineer has conducted an experiment to study the effect of temperature and pressure on the reaction time of a chemical process. The two factors are investigated at three levels each. The following data [Table] are obtained from two replications Data for illustration	**10Marks**	**L3**	**CO4**

		Pressure	Temperature (°C)					
		Mpa	100	120	140			
		100	23	31	36			
			25	32	39			
		110	35	34	31			
			36	35	34			
		120	28	27	26			
			27	25	24			

15		The yield of a chemical process, expressed in percentage of the theoretical maximum, is measured with each of two catalysts, A, B, and with no catalyst (Control:C). Five observations are made under each condition. Making the usual assumptions for an analysis of variance. Test the hypothesis that there is no difference in mean yield between the three conditions. Use the 5% level of significance.	**20 Marks**	**L3**	**CO5**

Catalyst A	Catalyst B	Control C
79.2	**81.5**	**74.8**
80.1	**80.7**	**76.5**
77.4	**80.5**	**74.7**
77.6	**81.7**	**74.8**
77.8	**80.6**	**74.9**

OR

16		A manufacturing engineer wants to investigate the effect of feed rate(mm/min) on the surface finish of a milling operation. He has selected three different feed rates i.e., 2,4 and 6 mm/min for study and decided to obtain four observations at each feed rate. Thus, this study consists of 12 experiments (3 levels x 4 observations). Since the order of experimentation should be random, a test sheet has to be prepared as explained below. The 12 experiments are serially listed below in Table	**20Marks**	**L3**	**CO5**

Experiment run number				
Feed rate	Observations (Surface roughness)			
(mm/min)				
2	1	2	3	4
4	5	6	7	8
6	9	10	11	12

17.		A Population consists of the five numbers 2,3,6,8 and 11. Consider all possible samples of size 2 that can be drawn without replacement from this population. Find a) the mean of the population b) the standard deviation of the population c) the mean of the sampling distribution of means and d) the standard deviation of the sampling distribution of means.	**20 Marks**	**L3**	**CO6**
		Or			
18.		A Population consists of the five numbers 2,3,6,8 and 11. Consider all possible samples of size 2 that can be drawn with replacement from this population. Find a) the mean of the population b) the standard deviation of the population c) the mean of the sampling distribution of means and d) the standard deviation of the sampling distribution of means.	**20 Marks**	**L3**	**CO6**

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