Reg. No.												

Question Paper Code	13691

ME - DEGREE EXAMINATIONS, APRIL / MAY 2025

First Semester

Industrial Safety Engineering

20PISMA101 – PROBABILITY AND STATISTICAL METHODS

Regulation – 2020

(Use of *Statistical Tables is permitted*)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Define Baye's theorem.	2	K2	CO1
2.	Define standard normal distribution.	2	K1	CO1
3.	Define unbiased estimator.	2	K1	CO2
4.	Can $y = 5 + 2.8x$ and $x = 3 - 0.5y$ $x = 3 - 0.5y$ be the regression lines of Y on X and X on Y respectively. Give suitable arguments.	2	K2	CO2
5.	Define critical region.	2	K1	CO3
6.	Write the applications of F-test.	2	K2	CO3
7.	Name the basic principles of experimental design.	2	K1	CO4
8.	Bring out any two advantages of RBD over CRD.	2	K2	CO4
9.	List out the four kinds of variation involved in time series analysis.	2	K2	CO5
10.	Define simple exponential smoothing.	2	K2	CO5

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) i) A discrete random variable X has the following probability distribution — *10 K3 CO1*

x	0	1	2	3	4	5	6	7	8
$P(x)$	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

(i) Find the values of a (ii) Find $P(0 < X < 3)$ (iii) Find $P(X \geq 3)$ (iv) Find the distribution function of X.

ii) If P has a Poisson distribution with $P(X = 2) = 3P(X = 3)$, find $P(X = 0)$. — *6 K3 CO1*

OR

b) i) Probability of a student passing a subject is 0.8. What is the probability that he will pass the subject (i) on his 3rd attempt (ii) before 3rd attempt? — *6 K3 CO1*

ii) If X is a uniform random variable in $0 < X < 10$. Find the probability that (i). $P(X < 2)$, (ii). $P(X > 8)$, (iii). $P(3 < X < 9)$. — *10 K3 CO1*

12. a) In the following table are recorded data showing the test scores made by salesman on an intelligence test and their weekly sales: *16 K3 CO2*

Salesmen	1	2	3	4	5	6	7	8	9	10
Test scores	40	70	50	60	80	50	90	40	60	60
Sales(thousands)	2.5	6	4.5	5	4.5	2	5.5	3	4.5	3

Calculate the regression line of sales on test scores and estimate the most probable weekly sales volume if a salesman makes a score of 70.

OR

b) For random sampling from normal population $N(\mu, \sigma^2)$, find the maximum likelihood estimators for μ and σ^2. 16 *K3 CO2*

13. a) (i) The mean height of two samples of 1000 and 2000 members are respectively 67.5 and 68 inches. Can they be regarded as drawn from the same population with standard deviation 2.5 inches? *8 K3 CO3*

(ii) In a sample of 400 parts produced by a factory, the number of defective parts was found to be 30. The company however claims that only 5% of their products are defective. Is the claim tenable? *8 K3 CO3*

OR

b) (i) In an experiment on immunization of people from Covid'19, the following results were obtained. *8 K3 CO3*

	Affected	*Not affected*
Inoculated	12	26
Not-inoculated	16	6

Calculate χ^2 and discuss the effect of vaccine in controlling susceptibility to Covid'19.

(ii) Two random samples gave the following results *8 K3 CO3*

Sample	*Size*	*Sample mean*	*Sample variance*
1	10	15	9
2	12	14	9

Examine whether the samples come from the same normal population.

14. a) A random sample is selected from each of three makes of ropes and their breaking strength (in pounds) are measured with the following results: *16 K3 CO4*

I	II	III
70	100	60
72	110	65
75	108	57
80	112	84
83	113	57
-	120	73
-	107	-

Test whether the breaking strength of the ropes differs significantly.

OR

b) A farmer wishes to test the effects of four different fertilizers A, B, C, D on the yield of wheat. In order to eliminate sources of error due to variability in soil fertility, he uses the fertilizers in Latin square arrangement as indicated with following table, where the numbers indicate yields in bushels per unit area. *16 K3 CO4*

A 18	C 21	D 25	B 11
D 22	B 12	A 15	C 19
B 15	A 20	C 23	D 24
C 22	D 21	B 10	A 17

Perform an analysis of variance to determine if there is a significant difference between the fertilizers at 0.05 level of significance.

15. a) Calculate three yearly moving average of the following data *16 K3 CO5*

Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
No. of. students	15	18	17	20	23	25	29	33	36	40

OR

b) Calculate the trend values by the method of least squares. Calculate the profit for the year 1979. *16 K3 CO5*

Year	1971	1972	1973	1974	1975	1976
Profits	83	92	71	90	169	191