Reg. No.															

Question Paper Code	12840

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

First Semester

Industrial Safety Engineering

20PISMA101 – PROBABILITY AND STATISTICAL METHODS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	If $P(A) = 0.65, P(B) = 0.4$ and $P(A \cap B) = 0.24$, can A and B be independent events?	2	K1	CO1
2.	State any two basic properties of a normal curve.	2	K1	CO1
3.	List out the characteristics of good estimators.	2	K2	CO2
4.	Define method of maximum likelihood estimator.	2	K2	CO2
5.	Write any four applications of t –distribution.	2	K1	CO3
6.	Write the test statistic for the difference of two standard deviations in a large sample test.	2	K2	CO3
7.	Define completely randomized design.	2	K1	CO4
8.	Define 2^2 factorial design.	2	K1	CO4
9.	Write the additive model of the time series analysis.	2	K1	CO5
10.	Define exponential smoothing.	2	K1	CO5

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) i) A discrete random variable X has the following probability distribution — 8 K3 CO1

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

(a) Find the values of a, (b) Find $P(0 < X < 3)$ (c) Find the distribution function of X.

ii) A continuous random variable X has the pdf $f(x) = K(1 - x)$, for $x < 1$. Find the r^{th} moment about the origin. Hence, find the mean and variance. — 8 K3 CO1

OR

b) Derive the moment generating function of uniform distribution and also find its mean and variance. — 16 K3 CO1

12. a) A random sample of x_1, x_2, x_3 & x_4 of size 4 is drawn from a normal population unknown mean μ. Consider the following estimators to estimate μ. (i) $t_1 = \frac{x_1+x_2+x_3+x_4}{4}$; (ii) $t_2 = \frac{x_1+x_2+x_3}{3} + x_4$; (iii) $t_3 = \frac{x_1+2x_2+\lambda x_3}{3}$, where λ is such that t_3 is an unbiased estimator. Find the value of λ. Are t_1 & t_2 unbiased? State giving reasons the estimator which is best among t_1, t_2 & t_3. *16 K3 CO2*

OR

b) The two regression lines are $8x - 10y + 66 = 0$; $40x - 18y - 214 = 0$. *16 K3 CO2*

(i) Find the mean values of $X$and Y.

(ii) Find the correlation co-efficient between X and Y.

13. a) Two researchers adopted different sampling techniques while investigating the same group of students to find the number of students falling in different intelligence levels. The results are as follows: *16 K3 CO3*

Researchers	Below Average	Average	Above Average	Genius	Total
X	86	60	44	10	200
Y	40	33	25	2	100
Total	126	93	69	12	300

Would you say that the sampling techniques adopted by the two researchers are independent?

OR

b) i) In a random sample of 1000 people in Mumbai city, 540 are rice eaters and rests are wheat eaters. Can we assume that both rice and wheat eaters are equally popular in this state at 1% level of significance? *8 K3 CO3*

ii) In a random sample of 1000 people from city A, 400 are found to be consumers of wheat. In a sample of 800 from city B, 400 are found to be consumers of wheat. Does the data give a significant difference between the two cities as far as the proportion of wheat consumers is concerned? *8 K3 CO3*

14. a) The following data represent the number of units of production per day turned out by different workers using 4 different types of machines: *16 K3 CO4*

Workers	**Machine Type**			
	A	B	C	D
1	44	38	47	36
2	46	40	52	43
3	34	36	44	32
4	43	38	46	33
5	38	42	49	39

(a) Test whether 5 workers are differ with respect to mean productivity?

(b) Test whether the mean productivity is the same for the four different machine types.

OR

b) Setup the analysis of variance for the following results of a Latin Square Design. Use $\alpha = 0.01$ level of significance. *16 K3 CO4*

A 12	C 19	B 10	D 8
C 18	B 12	D 6	A 7
B 22	D 10	A 5	C 21
D 12	A 7	C 27	B 17

15. a) The price of a commodity during 1980-1983 were as follows: *16 K3 CO5*

Years	Jan.-Mar.	Apr.-June	Jul.-Sep.	Oct.-Dec.
1980	321	348	348	348
1981	327	351	354	348
1982	342	359	381	345
1983	364	390	401	385

Compute the seasonal indices by the method of simple average.

OR

b) The prices of commodity during 1993 to 1998 are given below. Fit a parabola $Y = a + bX + CX^2$ to these data. Calculate the trend values. Estimate the price of the commodity for the year 1999. *16 K3 CO5*

Years	1993	1994	1995	1996	1997	1998
Price	100	107	128	140	181	192