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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

PhD Odd semester (M.Tech) Examination December 2024

Course Code & Name: 221TCE100 PROBABILITY AND STATISTICS

Max. Marks: 60 Duration: 2.5 Hours

(Statistical tables are allowed)

PART A

Answer all questions. Each question carries 5 marks Marks

1 The life time in hours of a certain electrical equipment has the normal distribution with mean 80 and standard deviation 16. What is the probability that the equipment lasts at least 100 hours? (5)

2 Explain Type I and Type II errors. (5)

3 As part of the investigation of the collapse of the roof of a building, a testing laboratory is given all the available bolts that connected the steel structure at 3 different positions on the roof. The force required to shear each of these bolts are as follows. (5)

Position: 1	90	82	79	98	83	91	
Position: 2	105	89	93	104	89	95	86
Position: 3	83	89	80	94			

Perform one way analysis of variance to test at 5% level of significance whether the differences among the sample means at the three positions are significant.

4 For the following data obtain regression line of y on x by the method of least squares (5)

X: 12 10 14 11 12 9

Y: 18 17 23 19 20 15

5 Calculate 3 yearly moving average for the following data (5)

Year	1	2	3	4	5	6	7	8	9	10	11
Value	242	250	252	249	253	255	251	257	260	265	262

PART B

Answer any 5 questions. Each question carries 7 marks

6 It is known that 5% of the books bound at a certain bindery have defective bindings. Find the probability that 2 out of 100 books bounded by this bindery will have defective bindings using (7)

(i) Formula for binomial distribution.

(ii) The Poisson approximation to binomial distribution.

7 A machine is designed to produce insulating washers for electrical devices of average thickness of 0.025 cm. A random sample of 10 washers was found to have an average thickness of 0.024 cm with a standard deviation of 0.002 cm. Test the significance of deviation (use $\alpha = 5\%$). (7)

8 An experiment was designed to study the performances of 4 different detergents for cleaning fuel injectors. The following cleanness readings were obtained with specially designed equipment for 12 tanks of gas distributed over 3 different models of engines. (7)

		Engine		
		1	2	3
Detergent	A	45	43	51
	B	47	46	52
	C	48	50	55
	D	42	37	49

Looking at the detergents as treatments and the engines as blocks, obtain the two-way analysis of variance table and test at 1% level whether there are differences in the detergents or engines.

9 The ranks of the same 15 students in two subjects A and B are given below. The two numbers within the brackets denoting the ranks of the same student in subjects A and B respectively. (1,10), (2,7), (3,2), (4,6), (5,4), (6,8), (7,3), (8,1), (9,11), (10,15), (11,9), (12,5), (13,14), (14,12), (15,13). Use Spearman's formula to find the rank correlation coefficient. (7)

10 Below are given the figures of production (in thousands of tons) of a sugar factory. Fit a linear trend to the data by the least square method. (7)

Year	1999	2000	2001	2002	2003	2004	2005
Production	77	88	94	85	91	98	90

11 Suppose that a new machine is put into operation at time zero. Its life time is an exponential random variable with mean life of 12 hours. (7)

(i) What is the probability that the machine will work continuously for one day?

(ii) Suppose that the machine has not failed by the end of the first day, what is the probability that it will work continuously for the whole of the next day?

12 I Q test were given to two groups of boys and girls gave the following results (7)

	Sample size	Mean score	S.D
Boys	60	75	8
Girls	100	73	10

Examine whether there is any significance difference between mean scores of boys and girls?

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