## SE (Civil) com IV R'20 c scheme

13-05-2025

(5)

(6)

(3 Hours)

[Total Marks: 80]

N.B.: 1) Question No. 1 is Compulsory.

- 2) Answer any THREE questions from Q.2 to Q.6.
- 3) Figures to the right indicate full marks.
- Q.1 (a) Fit a straight line to the following data

X	1	2	3,0	4	5	65
Y	49	54	60	73	80	86

(b) Calculate Correlation coefficient between the variables x and y for the following (5)

X	12	15	18	21	27
Y	2	4	6	8	12

- (c) Let X be a continuous random variable with probability density function  $f(x) = \frac{x}{6} + k, \ 0 \le x \le 3 \text{ Find } k \text{ and } (1 \le x \le 2).$  (5)
- (d) Find the line integral of  $\overline{F} = x^2i + xyj$  along line *OP* where, O = (0,0) and P = (1,1).
- Q.2 (a) A random variable x has the following probability function

X	-2	-1	0 3	1 450	2	3
P(x)	0.1	k	0.2	2k	0.3	3k

Find i) k ii) P(x > 2) iii) E(X)

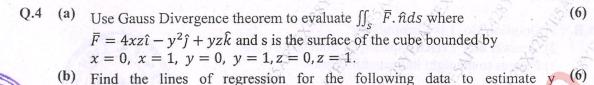
- (b) Prove that  $\overline{F} = (x + 2y + az)i + (bx 3y z)j + (4x + cy + 2z)k$  is solenoidal and find the constants a,b,c if  $\overline{F}$  is irrotational. (6)
- (c) Evaluate  $\int_{c}^{c} \frac{z+6}{z^{2}-4} dz$  where c is (i) |z| = 1 (ii) |z-2| = 1 (iii) |z+2| = 1. (8)
- Q.3 (a) The average breaking strength of steel rods is specified to be 17.5 (in units of 1000 kg) to test this sample of 14 rods tested & gave the following results: 15, 18, 16, 21, 19, 21, 17, 17, 15, 17, 20, 19, 17, 18. Is the result of the experiment significant?
  - (b) Use Green's theorem to evaluate  $\int_c (2x^2 y^2) dx + (x^2 + y^2) dy$  where c is the boundary of the region enclosed by the lines x = 0, y = 0, x = 2, y = 2.
  - (c) If height of 500 students are normally distributed with mean 68 inches and standard deviation 4 inches, Find the number of students having heights (i) greater than 72 inches (ii) between 65 and 71 inches (iii) less than 62 inches.

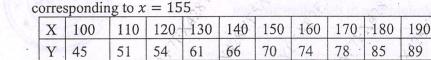
Q. P. code

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(c)	Find all possible Laurent's series expansion of the function $f(z) = -\frac{1}{2}$	(8)
	$\frac{5z+7}{(z+3)(z+2)}$ about $z=0$ indicating region of convergence.	8
	(z+3)(z+2)	7.V

- Q.5 (a) The standard deviation from two random samples of sizes 9 and 13 are 1.99 (6) and 1.9. Can the samples be regard as drawn from normal population with same standard deviation?  $(F_{(8,12)}(0.025) = 3.51, F_{(12,8)}(0.025) = 4.20)$ 
  - (b) Using Stoke's Theorem to evaluate  $\int_c \bar{F} . d\bar{r}$  where  $\bar{F} = yi + zj + xk$  (6) and c is the boundary of surface  $x^2 + y^2 = 1 z$ , z > 0.
  - (c) In an experiment on immunization of cattle from tuberculosis the following results were obtained (use 5% LOS)

700	Affected	Not Affected	Total
Inoculated	267	27	294
Not &	757	155	912
Inoculated	Day's L		4
Total	1024	182	1206

Use Chi Square test to determine the efficiency of vaccine in preventing tuberculosis.

- Q.6 (a) A bag contains 7 red balls and 3 black balls and another bag contains 4 red balls and 5 black balls. One ball is transferred from the first bag to the second bag then a ball is drawn from the second bag. If this ball happens to be red, Use Bayes' theorem to find the probability that a black ball was transferred.
  - (b) A car hire firm has 2 cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the probability of days on which some demand is refused.
  - (c) Show that  $\bar{F} = (2xy + z)i + (x^2 + 2yz^3)j + (3y^2z^2 + x)k$  is conservative. Find scalar potential such that  $\bar{F} = \nabla \emptyset$  and hence, find the work done by  $\bar{F}$  in displacing a particle from (1,2,0) to (2,2,1).

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