

SE (Civil / Mech)

A.M-IV

21/11/14

QP Code : 12404

[3 Hours]

[Total Marks: 80

- N.B. (1) Question no. 1 is compulsory.
 (2) Attempt any three of the remaining.
 (3) Use of statistical table is allowed.

1. (a) Using Green's theorem evaluate. 5
 $\int_C (xy+y^2)dx + x^2dy$ where C is the closed curve of the region bounded
 by $y=x$ and $y=x^2$.
 (b) Use Cayley-Hamilton theorem to find $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ in terms 5
 of A where $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$
 (c) A continuous random variable has probability density function 5
 $f(x) = 6(x-x^2)$ $0 \leq x \leq 1$ Find mean and variance.
 (d) A random sample of 900 items is found to have a mean of 65.3cms. Can 5
 it be regarded as a sample from a large population whose mean is 66.2cms.
 and standard deviation is 5 cms at 5% level of significance.

2. (a) Calculate the value of rank correlation coefficient from the following data 6
 regarding marks of 6 students in statistics and accountancy in a test

Marks in Statistics:	40	42	45	35	36	39
Marks in Accountancy:	46	43	44	39	40	43

- (b) If 10% of bolts produced by a machine are defective. Find the probability 6
 that out of 5 bolts selected at random at most one will be defective.
 (c) Show that the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ 8
 is diagonalisable. Find the transforming matrix and the diagonal matrix.

3. (a) In a laboratory experiment two samples gave the following results. 6

Sample	size	mean	sum of squares of deviations from the mean
1	10	15	90
2	13	14	108

Test the equality of sample variances at 5% level of significance.

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3. (b) Find the relative maximum or minimum of the function.
 $z = x_1^2 + x_2^2 + x_3^2 - 6x_1 - 10x_2 - 14x_3 + 103$
- (c) Prove that $\vec{F} = (y^2 \cos x + z^3)\mathbf{i} + (2y \sin x - 4)\mathbf{j} + (3xz^2 + 2)\mathbf{k}$ is a conservative field. Find the scalar potential for \vec{F} and the workdone in moving an object in this field from $(0, 1, -1)$ to $(\frac{\pi}{2}, -1, 2)$

4. (a) The weights of 4000 students are found to be normally distributed with mean 50kgs. and standard deviation 5kgs. Find the probability that a student selected at random will have weight (i) less than 45 kgs.
(ii) between 45 and 60 kgs.

- (b) Use Gauss's Divergence theorem to evaluate

$$\iiint_V \vec{N} \cdot \vec{F} \, ds \text{ where } \vec{F} = 4x\hat{i} + 3y\hat{j} - 2z\hat{k} \text{ and } s \text{ is the surface bounded by } x=0, y=0, z=0 \text{ and } 2x+2y+z=4$$

- (c) Based on the following data, can you say that there is no relation between smoking and literacy.

	smokers	nonsmokers
Literates	83	57
Illiterates	45	68

5. (a) A random variable X follows a Poisson distribution with variance 3 calculate $p(X=2)$ and $p(X \geq 4)$

- (b) Use Stoke's theorem to evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = x^2\mathbf{i} + xy\mathbf{j}$ and C is the boundary of the rectangle $x=0, y=0, x=a, y=b$

- (c) Find the equations of the two lines of regression and hence find correlation coefficient from the following data.

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

6. (a) Two independent samples of sizes 8 and 7 gave the following results. 6

Sample 1: 19 17 15 21 16 18 16 14
Sample 2: 15 14 15 19 15 18 16

Is the difference between sample means significant.

6. (b) If $A = \begin{bmatrix} 2 & 3 \\ -3 & -4 \end{bmatrix}$ find A^{50} 6
- (c) Use the Kuhn-Tucker Conditions to solve the following N.L.P.P 8
- Maximise $z = 2x_1^2 - 7x_2^2 + 12x_1x_2$
Subject to $2x_1 + 5x_2 \leq 98$
 $x_1, x_2 \geq 0$
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