13/5/2016 SE Sem-IV Mech/Mechatronic. Sub - APM-IV (CBSGS)

Q. P.Code : 538900

(Three Hours) Total Marks : 80

N.B : (1) Question No.1 is compulsory.

(2) Attempt any 3 from remaining 6 questions.

(3) Figures to the right indicate fullmarks

Q 1 (a) Prove that $F = (z^2 + 3y + 2x)i + (3x + 2y + z)j + (y + 2zx)k$ is irrotational and find it's Scalar potential. (5)

(b) If $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.

Find the characteristic roots of A and $A^2 + I$. (5)

(c) The probability of a man hitting the target is 1/4. How many times must he fire so that the probability of his hitting the target atleast once is greater than 2/3? (5)

(d) A random sample of 400 members is found to have a mean of 4.45 cms. Can it be reasonably regarded as a sample from large population whose mean is 5 cms and whose variance is 4 cms. (5)

Q2 (a) From the following data calculate the coefficient of rank correlation between X and Y. (6)

X: 32, 55, 49, 60, 43, 37, 43, 49, 10, 20

Y: 40, 30, 70, 20, 30, 50, 72, 60, 45, 25

(b) The daily consumption of electric power (in million kwh) is a random variable x with p.d.f (6)

$f(x) = kx\, e^{-x/5}$ for $x > 0$

$= 0$ for $x \leq 0$

Find the value of k, the mathematical expectation and the probability that on a

[Turnover

given day , the electric consumption is more than the expected value .

(c) Show that the given matrix $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ is diagonalizable (8).

Find the transforming matrix and diagonal form .

Q 3 (a) A certain injection administered to 12 patients resulted in the following (6)
Changes in blood pressure .

5, 2 , 8 , -1, 3, 0, 6 , -2, 1 , 5 , 0 , 4

Can it be concluded that the injection will be in general accompanied by an increase in blood pressure .

(b) Using the Langrangian multiplier method solve the following N.L.P.P (6)

Optimise $z = 2x_1^2 + 2x_2^2 + 2x_3^2 - 24x_1 - 8x_2 - 12x_3 + 196$
subject to $x_1 + x_2 + x_3 = 11$

(c) Verify Green's theorem in the plane for $\oint \frac{1}{y} dx + \frac{1}{x} dy$ where C is the boundary of the region defined by $y = 1, x = 4, y = \sqrt{x}$ (8)

Q4 (a) A woman with n keys with her wants to open the door of her house by (6)
trying the keys independently and randomly one by one .Find the mean And the variance of the no of trials required to open the door if unsuccessful Keys are kept aside .

(b)Use Gauss theorem to evaluate $\iint_s \overline{F}.d\overline{s}$ where $\overline{F} = x\,i - 3y^2\,j + z\,k$ over the surface of the cylinder $x^2 + y^2 = 16$ between $z = 0$ and $z = 5$ (6)

(c) Twelve dice were thrown 4096 times and the number of appearace of 6 each time was noted. (8)

No of successes:	0	1	2	3	4	5	6 and above
Frequency :	447	1145	1181	796	380	115	32

5 (a) Marks obtained by students in an examination follow a normal distribution (6)

If 30% of students got below 35 marks and 10% got above 60 marks. Find the Mean and the standard deviation.

(b) Using Stoke's theorem find the work done in moving a particle once around (6)

the perimeter of the triangle ABC cut off by the plane 3x+2y+z=6 on the co-ordinate axes under the force F =(x+y)i+(2x-z)j+(y+z)k

(C) The eqations of two regression lines are 3x+2y=26 and 6x+y =31 (8)

Find (i) the means of x and y (ii) co efficient of correlation between x and y.

(iii) σ_y *if* $\sigma_x = 3$

6(a) A group of 10 rats fed on diet A and another group of 8rats fed on different (6)

diet B, recorded the following increase in weight.

Diet A : 5 , 6 , 8 , 1, 12, 4, 3, 9, 6, 10 gms

Diet B : 2, 3 , 6, 8, 1 , 10 , 2, 8 gms

Find if the variances are significantly different ? (6)

(b) If $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. Prove that $A^{50} - 5A^{49} = \begin{bmatrix} 4 & -4 \\ -2 & 2 \end{bmatrix}$

(c) Using Kuhn-Tucker conditions solve following N.L.P.P (8)

Maximise $z = 2x_1 + 3x_2 - x_1^2 - x_2^2$

Subject to $x_1 + x_2 \le 1$

$2x_1 + 3x_2 \le 6 \quad x_1, x_2 \ge 0$
