S.E. (Civil). Sem IV. (Choice Based).

AM - IV

11/5/18

Q.P. Code: 38582

40793

Duration – 3 Hours **Total Marks: 80**

(1) N.B.:-Question no 1 is compulsory.

(2) Attempt any THREE questions out of remaining FIVE questions.

Q.1) a) If λ is an eigen value of matrix A,then prove that λ^n is an eigen value of A^n and hence find the eigen values for $A^2 + 2A + 5I$,where $A=\begin{bmatrix} 2 & 1 & -2 \\ 0 & 2 & 4 \\ 0 & 0 & 3 \end{bmatrix}$. (5)

b) The probability density function of a random variable X is $f(x) = kx^2(1 - x^3), 0 \leq x \leq 1$. Find k, expectation and variance of x. (5)

c) A machine is set to produce metal plates of thickness 1.5 cm with standard deviation 0.2 cm.A sample of 100 plates produced by the machine gave an average thickness of 1.52 cm.Is the machine fulfilling the purpose? (5)

d) Write the dual of the given LPP ; (5)

Minimize $z = 2x_1 + 3x_2 + 4x_3$

Subject to: $2x_1 + 3x_2 + 5x_3 \geq 2,\ 3x_1 + x_2 + 7x_3 = 3,$

$x_1 + 4x_2 + 6x_3 \leq 5,$

$x_1, x_3 \geq 0$ and x_2 is unrestricted.

Q.2 a) Check whether the given matrix A is diagonalizable, diagonalize if it is,where $A=\begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$. (6)

b) Verify Green's theorem for $\vec{F} = (x^2 - y)i + (2y^2 + x)j$ where C is the boundary of region bounded by $y = x^2$, $y = 4$. . (6)

c) The heights of six randomly chosen sailors are in inches :63,65,68,69,71 and 72 .The heights of ten randomly chosen soldiers are: 61,62,65,66,69,69,70,71,72 and 73. (8)

Discuss in the light that these data throw on the suggestion that the soldiers on an average taller than sailors.

Q.3 a) Use Big-M method to solve (6)

-11+1+5

Minimize $z = 10x_1 + 3x_2$

Subject to: $x_1 + 2x_2 \geq 3$, $x_1 + 4x_2 \geq 4$

$x_1, x_2 \geq 0$

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b) Using Gauss Divergence Theorem, evaluate $\iint_S \overline{F} \bullet \overline{n} dS$, where S is the surface of the region bounded by cylinder $x^2 + y^2 = 4, z = 0, z = 6$ and $\overline{F} = 2xi + xyj + zk$. (6)

c) Find the rank, index, signature and class of the following Quadratic Form by reducing it to its canonical form using Congruent transformations $4x^2 + 3y^2 + 12z^2 - 8xy + 16yz - 20xz$. (8)

Q. 4 a) The number of accidents in a year attributed to taxi drivers in a city follow Poisson distribution with mean 3. Out of 1,000 taxi drivers, find approximately the number of drivers, with (i) no accident in a year, (ii) more than 3 accidents in a year. (6)

b) Verify Cayley Hamilton Theorem and hence find A^{-1}, if A= $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ (6)

c) In a test given to two groups of students drawn from two normal Populations marks obtained were as follows: (8)

Group A: 18, 20, 36, 50, 49, 36, 34, 49, 41

Group B: 29, 28, 26, 35, 30, 44, 46

Examine the equality of variances.

(Given: $F(0.025) = 5.6$ with d. f. 8 & 6 and $F(0.025) = 4.65$ with d. f. 6 & 8.)

Q. 5 a) Show that A= $\begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{bmatrix}$ is derogatory and hence find minimal polynomial. (6)

b) Prove that $\overline{F} = (2xyz^2)i + (x^2z^2 + z\cos yz)j + (2x^2yz + y\cos yz)k$ is irrotational. Find ϕ such that $\overline{F} = \nabla\phi$. Hence find the work done in moving an object in this field from $(0,0,1)$ to $(1, \pi/4, 2)$. (6)

c) Out of a sample 120 persons in a village, 76 were administered a new drug for preventing influenza and out of them 24 persons were attacked by influenza. Out of these who were not administered the new drugs, 12 persons were not affected by influenza. Use Chi-square method to find out whether the new drug is effective or not? (8)

3+3+3

Q. 6 a) Evaluate $\int_C (x+2y)dx+(x-z)dy+(y-z)dz$ where C is the boundary of the triangle with vertices $(2,0,0),(0,3,0),(0,0,6)$ oriented in the anti-clockwise direction. (6)

b) Ten individuals are chosen at random from a population and their heights are found to be (inches): 63, 63, 65 66,67,68,69,70,71 and 71. In the light of the data, discuss the suggestion that the mean height in the population is 66 inches. (6)

c) Using dual simplex method solve the given LPP (8)

Minimize $z = 2x_1 + x_2$

Subject to: $3x_1 + x_2 \geq 3$, $4x_1 + 3x_2 \geq 6$, $x_1 + 2x_2 \leq 3$

$x_1, x_2 \geq 0$

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