# University of Mumbai

## Examination First Half 2022 under cluster __ (Lead College: _____)

**Examinations Commencing from 16 MAY 2022 to 30 MAY 2022**

Program: **__BE COMPUTER ENGINEERING _____**

Curriculum Scheme: Rev2019 ( C scheme )

Examination: SE Semester : IV

Course Code: _CSC 401____ and Course Name: ___Engineering Mathematics_IV

Time: 2 hour 30 minutes Max. Marks: 80

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| **Q1.** | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
|---|---|
| 1. | If X is a Poisson variate and P(X=1)=P(X=2) ,then $E(X^2)$ is |
| Option A: | 1 |
| Option B: | 5 |
| Option C: | 8 |
| Option D: | 6 |
| | |
| 2. | If $A = \begin{bmatrix} 2 & 0 & -1 \\ 0 & 2 & 0 \\ -1 & 0 & 2 \end{bmatrix}$ Eigen value of Adj. A are |
| Option A: | 5,6,2 |
| Option B: | 2,3,6 |
| Option C: | 5,3,6 |
| Option D: | 1,3,6 |
| | |
| 3. | If $f(z) = \frac{3z^2+z}{z^2-1}$ , then residue of f(z) at z= -1 is |
| Option A: | 1 |
| Option B: | -1 |
| Option C: | 2 |
| Option D: | -2 |
| | |
| 4. | The value of $\int_C \frac{\cos \pi z}{z^2-1} dz$ where C is the circle $\|z\| = 1/2$ |
| Option A: | πi |
| Option B: | 2 πi |
| Option C: | 0 |
| Option D: | - πi |
| | |
| 5. | According to Time shifting property of z-transform, if X(z) is the z-transform of x(n) then what is the z-transform of x(n-k)? |
| Option A: | $z^{-k}X(z)$ |
| Option B: | $z^{k}X(z)$ |
| Option C: | X(z+k) |
| Option D: | X(z-k) |
| | |
| 6. | The value of $Z^{-1}\left[\frac{z^2}{(z-a)(z-b)}\right]$ is |
| Option A: | $\frac{a^{n+1}-b^{n+1}}{a+b}$ |

| | |
|---|---|
| Option B: | $\frac{a^{n+1}+b^{n+1}}{a-b}$ |
| Option C: | $\frac{a^{n+1}-b^{n+1}}{a-b}$ |
| Option D: | $\frac{a^{n+1}+b^{n+1}}{a+b}$ |
| | |
| 7. | If a random variable X follows Poisson distribution such that P(X=0)=6P(X=3), find the mean and variance of the distribution. |
| Option A: | $mean = 1, variance = 1$ |
| Option B: | $mean = 1, variance = -1$ |
| Option C: | $mean = 1, variance = 2$ |
| Option D: | $mean = 1, variance = -2$ |
| | |
| 8. | In normal distribution |
| Option A: | Mean = Median = Mode |
| Option B: | Mean < Median < Mode |
| Option C: | Mean> Median > Mode |
| Option D: | Mean ≠ Median ≠ Mode |
| | |
| 9. | If the primal LPP has an unbounded solution then the dual has |
| Option A: | Unbounded solution |
| Option B: | Bounded solution |
| Option C: | Feasible solution |
| Option D: | Infeasible solution |
| | |
| 10. | The value of Lagrange's multiplier $\lambda$ for the following NLPP is<br>Optimize $z = 6x_1^2 + 5x_2^2$<br>Subject to $x_1 + 5x_2 = 7$<br>$x_1, x_2 \geq 0$ |
| Option A: | $\lambda = 31/84$ |
| Option B: | $\lambda = 84/31$ |
| Option C: | $\lambda = 13/74$ |
| Option D: | $\lambda = 31/64$ |

| **Q2** | **Solve any Four out of Six** **5 marks each** |
|---|---|
| A | Given $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$, find the eigenvalues of A. Also find eigenvalues of $4A^{-1}$ and eigenvector of $A^2 - 4I$ . |
| B | Evaluate $\int_0^{1+i}(x^2 - iy)dz$ along the path (i) $x^2 = y$ (ii) y = x |
| C | Find $Z\{2^k \cos(3k+2)\}, k \geq 0$. |
| D | The following table gives the number of accidents in a city during a week. Find whether the accidents are uniformly distributed over a week |

| Day | Sun | Mon | Tue | Wed | Thu | Fri | Sat | Total |
|---|---|---|---|---|---|---|---|---|

| | |
|---|---|
| | No. of accidents: 13, 15, 9, 11, 12, 10, 14, 84 |
| E | Solve by Simplex Method<br>$Maximise \quad z = 7x_1 + 5x_2$<br>Subject to $-x_1 - 2x_2 \geq -6$<br>$4x_1 + 3x_2 \leq 12$<br>$x_1, x_2 \geq 0$ |
| F | Solve the following NLPP<br>$Maximise \quad z = -2{x_1}^2 - {x_2}^2 + 10x_1 + 4x_2$<br>Subject to $2x_1 + x_2 \leq 5$<br>$x_1, x_2 \geq 0$ |

| **Q3** | **Solve any Four out of Six** **5 marks each** |
|---|---|
| A | Find the Eigen values and Eigen Vectors of the following matrix.<br>$A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 3 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ |
| B | Evaluate $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)}\, dz$ where C is the circle $\lvert z\rvert = 3$ |
| C | Obtain inverse z-transform $\frac{z+2}{z^2-2z-3}$, $1 < \lvert z\rvert < 3$ |
| D | The height of six randomly chosen sailors are in inches: 63,65,68,69,71,72. The height of 10 randomly chosen soldiers are: 61,62,65,66,69,69,70,71,72 and 73. |
| E | Solve by the dual Simplex Method<br>$Minimise \quad z = 6x_1 + 3x_2 + 4x_3$<br>Subject to $x_1 + 6x_2 + x_3 = 10$<br>$2x_1 + 3x_2 + x_3 = 15$<br>$x_1, x_2 \geq 0$ |
| F | Find the relative maximum or minimum of the function<br>$z = {x_1}^2 + {x_2}^2 + {x_3}^2 - 8x_1 - 10x_2 - 12x_3 + 100$ |

| **Q4** | **Solve any Four out of Six** **5 marks each** |
|---|---|
| A | Show that the following matrix is diagonalizable. Also find the diagonal form and a diagonalizing matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ |
| B | Evaluate $\int_C \frac{4z^2+1}{(2z-3)(z+1)^2)}\, dz$, $C: \lvert z\rvert = 4$ using Cauchy's residue theorem. |
| C | Find the inverse z-transforms of $F(z) = \frac{z}{(z-1)(z-2)}$; $\lvert z\rvert > 2$ |

| | |
|---|---|
| D | If the heights of 500 students is normally distributed with mean 68 inches and standard deviation 4 inches, estimate the number of students having heights (i) greater than 72 inches<br>(ii) less than 62 inches (iii) between 65 and 71 inches. |
| E | Using Simplex method<br>Maximize $z = 10x_1 + 6x_2 + 5x_3$<br>Subject to $2x_1 + 2x_2 + 6x_3 \leq 300$<br>$10x_1 + 4x_2 + 5x_3 \leq 600$<br>$x_1 + x_2 + x_3 \leq 100$<br>$x_1, x_2, x_3 \geq 0$ |
| F | Using Lagrange's multiplier<br>optimize $z = 4\,x_1 + 6x_2 - 2\,{x_1}^2 - 2\,x_1\,x_2 - 2{x_2}^2$<br>subject to $x_1 + 2x_2 = 2$<br>$x_1, x_2 \geq 0$ |