**Sample Questions**

Computer Engineering / Artificial Intelligence and Data Science / Artificial Intelligence and Machine Learning / Computer Science and Engineering (Artificial Intelligence and Machine Learning) / Computer Science and Engineering (Data Science) / Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology) / Cyber Security / Data Engineering / Internet of Things (IoT)

**Subject Name:** Engineering Mathematics IV **Semester: IV**

**Multiple Choice Questions**

|  | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
| --- | --- |
| 1. | The region of rejection of the null hypothesis H0 is known as |
| Option A: | Critical region |
| Option B: | Favourable  region |
| Option C: | Domain |
| Option D: | Confidence region |
|  |  |
| 2. | Sample of two types of electric bulbs were tested for length of life and the following data were obtained   |  | Size | Mean | SD | | --- | --- | --- | --- | | Sample 1 | 8 | 1234 h | 36 h | | Sample 2 | 7 | 1036 h | 40 h |   The absolute value of test statistic in testing the significance of difference between means is |
| Option A: | t=10.77 |
| Option B: | t=9.39 |
| Option C: | t=8.5 |
| Option D: | t=6.95 |
|  |  |
| 3. | If X is a poisson variate such that PX=1=PX=2, then P(X=3) is |
| Option A: | 4e23 |
| Option B: | 4e2 |
| Option C: | 43e2 |
| Option D: | 4e2 |
|  |  |
| 4. | If A=1 0 0  0 0  2 0  0 3   , Then following is not the eigenvalue ofadj A. |
| Option A: | 6 |
| Option B: | 2 |
| Option C: | 4 |
| Option D: | 3 |
|  |  |
| 5. | For the matrix2 -1 1  1 1  2 -1  -1 2   the eigenvector corresponding to the distinct eigenvalue λ=2 is |
| Option A: | 1 1 1 |
| Option B: | -1 1 1 |
| Option C: | 2 1 1 |
| Option D: | 1 2 1 |
|  |  |
| 6. | The necessary and sufficient condition for a square matrix to be diagonalizable is that for each of it’s eigenvalue |
| Option A: | algebraic multiplicity > geometric multiplicity |
| Option B: | algebraic multiplicity = geometric multiplicity |
| Option C: | algebraic multiplicity < geometric multiplicity |
| Option D: | algebraic multiplicity geometric multiplicity |
|  |  |
| 7. | If the characteristic equation of a matrix A of order 3×3 is 3-72+11λ-5=0, then by the Cayley-Hamilton theorem A-1 is equal to |
| Option A: | 15(A3-7A2+11A) |
| Option B: | 15(A2+7A+11I) |
| Option C: | 15(A3+7A2+11A) |
| Option D: | 15(A2-7A+11I) |
|  |  |
| 8. | Value of an integral 01+ix2-iydz along the path y=x2 is |
| Option A: | 56-i6 |
| Option B: | -56-i6 |
| Option C: | 56+i6 |
| Option D: | -56+i6 |
|  |  |
| 9. | Integral 5z2+7z+1z+1 dz along a circle z=12is equal to |
| Option A: | 1 |
| Option B: | -1 |
| Option C: | 3/2 |
| Option D: | 0 |
|  |  |
| 10. | Analytic function gets expanded as a Laurent series if the region of convergence is |
| Option A: | rectangular |
| Option B: | triangular |
| Option C: | circular |
| Option D: | annular |
|  |  |
| 11. | Residue of fz=z2z+12(z-2) at a pole z=2 is |
| Option A: | 4/9 |
| Option B: | 2/9 |
| Option C: | 1/2 |
| Option D: | 0 |
|  |  |
| 12. | z-transform of an unit impulse function k=1 ,       at k=0  0 ,    otherwise   is |
| Option A: | 1 |
| Option B: | 0 |
| Option C: | -1 |
| Option D: | k |
|  |  |
| 13. | zsin (3k+5) ,  k≥0   is |
| Option A: | z2sin 2-zsin 5  z2-2zcos 3+1 |
| Option B: | z2sin 5+zsin 2  z2-2zcos 3+1 |
| Option C: | z2sin 5-zsin 2  z2-2zcos 3+1 |
| Option D: | z2sin 2+zsin 5  z2-2zcos 3+1 |
|  |  |
| 14. | The inverse z-transform of fz=zz-1z-2      ,z>2  is |
| Option A: | 2k-2 |
| Option B: | 2k-1 |
| Option C: | 2k+1 |
| Option D: | 2k+2 |
|  |  |
| 15. | If the basic solution of LPP is x=1, y=0 then the solution is |
| Option A: | Feasible and non-Degenerate |
| Option B: | Non-Feasible and Degenerate |
| Option C: | Feasible and Degenerate |
| Option D: | Non-Feasible and non-Degenerate |
|  |  |
| 16. | 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 |
|  |  |
| 17. | Dual of the following LPP is  Maximize z=2x1+9x2+11x3  Subject to x1-x2+x3≥3 -3x1+2x3≤1 2x1+x2-5x3=1  x1,x2,x3≥0 |
| Option A: | Minimize w=-3y1+y2+y'  Subject to -y1-3y2+2y'≥2 y1+y'≥9 -y1+2y2-5y'≥11  y1,y2≥0, y’ unrestricted |
| Option B: | Minimize w=-3y1+y2+y3  Subject to -y1-3y2+2y3≥2 y1+y3≥9 -y1+2y2-5y3≥11  y1,y2,y3≥0 |
| Option C: | Minimize w=2y1+9y2+11y'  Subject to -y1-3y2+2y'≥3 y1+y'≥1 -y1+2y2-5y'≥1  y1,y2≥0, y’ unrestricted |
| Option D: | Minimize w=2y1+9y2+11y3  Subject to -y1-3y2+2y3≥3 y1+y3≥1 -y1+2y2-5y3≥1  y1,y2≥0, y’ unrestricted |
|  |  |
| 18. | Consider the NLPP:  Maximize z=f(x1,x2), subject to the constraint h=gx1,x2-b≤0.  Let L=f-λg, then the Kuhn-Tucker conditions are |
| Option A: | ∂Lx1≥0,  ∂Lx2≥0,  λh≥0,  h≥0,  λ≥0 |
| Option B: | ∂Lx1=0,  ∂Lx2=0,  λh=0,  h≤0,  λ≥0 |
| Option C: | ∂Lx1=0,  ∂Lx2=0,  λh≥0,  h≤0,  λ≤0 |
| Option D: | ∂Lx1≥0,  ∂Lx2≥0,  λh≥0,  h≥0,  λ=0 |
|  |  |
| 19. | In a non-linear programming problem, |
| Option A: | All the constraints should be linear |
| Option B: | All the constraints should be non-linear |
| Option C: | Either the objective function or atleast one of the constraints should be non-linear |
| Option D: | The objective function and all constraints should be linear. |
|  |  |
| 20. | Pick the non-linear constraint |
| Option A: | xy+y≥7 |
| Option B: | 2x-y≤5 |
| Option C: | x+y≤6 |
| Option D: | x+2y=9 |
|  |  |
| 21. | The Eigen values of  adjA   where |
| Option A: | 1, 1 |
| Option B: | 1, 2 |
| Option C: | 3, 4 |
| Option D: | 2, 5 |
|  |  |
| 22. | If the algebraic multiplicity ‘t’ of is equal to the geometric multiplicity ‘s’, then the matrix is |
| Option A: | Orthogonal |
| Option B: | Symmetric |
| Option C: | Diagonalizable |
| Option D: | None of these |
|  |  |
| 23. | The product of eigen values for is |
| Option A: | 4 |
| Option B: | 0 |
| Option C: |  |
| Option D: | 3 |
|  |  |
| 24. | Two of the eigen values of a matrix are 2.  If the determinant of the matrix is 4, then its third eigen value is |
| Option A: | 2 |
| Option B: |  |
| Option C: | 7 |
| Option D: | 5 |
|  |  |
| 25. | The value of the sample statistic which separates the regions of acceptance and rejection, is called the |
| Option A: | Accepted value |
| Option B: | Critical value |
| Option C: | Rejected Value |
| Option D: | Separated value |
|  |  |
| 26. | The table value of at is |
| Option A: |  |
| Option B: |  |
| Option C: |  |
| Option D: |  |
|  |  |
| 27. | If a random variable X follows Poisson distribution such that , the mean and the variance of the distribution is |
| Option A: | 7 |
| Option B: | 4 |
| Option C: |  |
| Option D: | 1 |
|  |  |
| 28. | The function has the singularity at is of the type |
| Option A: | Non isolated singularity |
| Option B: | Isolated singularity |
| Option C: | Removable singularity |
| Option D: | Isolated essential singularity |
|  |  |
| 29. | Evaluate  where c is the circle z=2 |
| Option A: | 1 |
| Option B: | I |
| Option C: | 2πi |
| Option D: | 0 |
|  |  |
| 30. | Pole of |
| Option A: | z = 3 pole of order 2 and z = 2 pole of order 3 |
| Option B: | z = 3 and z = 2 are simple pole |
| Option C: | pole of order 2 and pole of order 3 |
| Option D: | and are simple pole |
|  |  |
| 31. | The analytic function has singularity at |
| Option A: | 1 and |
| Option B: | 1 and |
| Option C: | 1 and |
| Option D: | and |
|  |  |
| 32. | The Z- transform of Discrete Unit Step function   is given by |
| Option A: | , |
| Option B: | , |
| Option C: | , |
| Option D: | , |
|  |  |
| 33. | Find the Z- transform of fk= ak , k≥0 |
| Option A: | zz+a |
| Option B: | 11-az |
| Option C: | 11+az |
| Option D: | zz-a |
|  |  |
| 34. | If then is |
| Option A: |  |
| Option B: |  |
| Option C: |  |
| Option D: |  |
|  |  |
| 35. | For a maximizing LPP, during the simplex method, the criteria for a variable to enter into the basis is |
| Option A: | Minimum ratio test |
| Option B: | Maximum ratio test |
| Option C: | Minimum deviation entry |
| Option D: | Maximum deviation entry |
|  |  |
| 36. | The advantage of dual simplex algorithm is that |
| Option A: | It starts with a basic feasible solution |
| Option B: | It involves artificial variable |
| Option C: | It does not involve artificial variable |
| Option D: | It involves dual variables |
|  |  |
| 37. | In a Simplex table, the pivot row is computed by |
| Option A: | dividing every number in the profit row by the pivot number. |
| Option B: | dividing every number in the pivot row by the corresponding number in the profit row. |
| Option C: | dividing every number in the pivot row by the pivot number. |
| Option D: | dividing every number in the net profit row by the corresponding number in the gross profit row. |
|  |  |
| 38. | The value of  Lagrange’s multiplier for the following NLPP is  Optimize  Subject to |
| Option A: |  |
| Option B: |  |
| Option C: |  |
| Option D: |  |
|  |  |
| 39. | If the objective function of NLLP is maximization type, then in Kuhn-Tucker conditions is |
| Option A: | λ=0 |
| Option B: | λ<0 |
| Option C: | λ≥0 |
| Option D: | λ  is not defined |
|  |  |
| 40. | In a non-linear programming problem (NLPP), |
| Option A: | All the constraints should be linear |
| Option B: | All the constraints should be non-linear |
| Option C: | Either the objective function or at least one of the constraints should be non-linear |
| Option D: | The objective function and all constraints should be linear. |
|  |  |
| 41. | If A=2 3 1 0 -1 0 0 0 3 then eigen values of A2+2I are |
| Option A: | 6,3,11 |
| Option B: | 2,-1,3 |
| Option C: | 4,3,-1 |
| Option D: | 0,3,2 |
|  |  |
| 42. | If A=-2 2 -3 2 1 -6 -1 -2 0 then by Cayley-Hamilton theorem |
| Option A: | 2A3+A2-10A-45I=0 |
| Option B: | A3-A2+16A-5I=0 |
| Option C: | A3+A2-21A-45I=0 |
| Option D: | A3+2A2-2A-9I=0 |
|  |  |
| 43. | If A=2 1 1 2 is diagonalisable then the diagonal matrix is |
| Option A: | D=1 0 0 3 |
| Option B: | D=-1 0 0 3 |
| Option C: | D=2 0 0 3 |
| Option D: | D=-1 0 0 5 |
|  |  |
| 44. | If A is a singular matrix of order 3×3 then one of the eigen value of A is |
| Option A: | 1 |
| Option B: | 0 |
| Option C: | 3 |
| Option D: | -1 |
|  |  |
| 45. | If C the upper half of the unit circle then the value of ZdZ over C is |
| Option A: | πi |
| Option B: | 0 |
| Option C: | -πi |
| Option D: | 2πi |
|  |  |
| 46. | The value of CZ+3(Z-4)(Z+2)2 , C:Z=1 is |
| Option A: | 0 |
| Option B: | 4πi |
| Option C: | -πi |
| Option D: | 2πi |
|  |  |
| 47. | fz=sin z z  has the singularity at z=0 is of the type |
| Option A: | Non isolated singularity |
| Option B: | Isolated singularity |
| Option C: | Isolated essential singularity |
| Option D: | Removable singularity |
|  |  |
| 48. | If fz=z2(z+2)(z-1)2   then residue at the pole z=-2 is |
| Option A: | 49 |
| Option B: | 13 |
| Option C: | 29 |
| Option D: | 0 |
|  |  |
| 49. | The Z-transform of fk= 3k ,  k<0 is |
| Option A: | z3-z  ,  z<3 |
| Option B: | 33-z  ,  z<3 |
| Option C: | zz-3  ,  z<3 |
| Option D: | z3-z  ,  z>3 |
|  |  |
| 50. | If Z transform of fk=F(Z) then Zakf(k) is |
| Option A: | akF(za) |
| Option B: | ddzF(z) |
| Option C: | F(za) |
| Option D: | znF(z) |
|  |  |
| 51. | Inverse Z-transform of zz-4, z>4  is |
| Option A: | -4k , k≥0 |
| Option B: | 4k , k≥0 |
| Option C: | -4k , k≤0 |
| Option D: | 4k , k<0 |
|  |  |
| 52. | If a random variable X follows Poisson distribution such that  P ( X=1) = 3P(X=2)  then  mean and variance of the distribution are |
| Option A: | Mean = 1, variance = 1 |
| Option B: | Mean = 0, variance = 1 |
| Option C: | Mean = 2/3, variance = 2/3 |
| Option D: | Mean = 3/2, variance = 1/2 |
|  |  |
| 53. | If X is a normal variate with mean 9 and S.D. 6, then P(|X-15|)1 is............         (given area between z=0 to z=1 is 0.3413) |
| Option A: | 0.3413 |
| Option B: | 1.0239 |
| Option C: | 0.6826 |
| Option D: | 0.2316 |
|  |  |
| 54. | To test independence of attributes, the degree of freedom is |
| Option A: | (r-1)(c+1) |
| Option B: | (r-1)(c-1) |
| Option C: | (r+1)(c-1) |
| Option D: | (r+1)(c+1) |
|  |  |
| 55. | Basic feasible solution of the LPP is said to be degenerate if |
| Option A: | One or more values of basic variable are zero. |
| Option B: | All basic variables are positive. |
| Option C: | All basic variables are negative. |
| Option D: | Some basic variables are positive and some basic variables are negative. |
|  |  |
| 56. | If the given LPP is in canonical form , then the primal-dual pair is said to be |
| Option A: | Symmetric |
| Option B: | Asymmetric |
| Option C: | Standard |
| Option D: | Pseudo |
|  |  |
| 57. | The Standard form of following  LPP is  Minimise  Z= -2x1+x2    Subject to   3x1-2x2≥-4  x1+4x2≤7  x1,x2≥0 |
| Option A: | Maximise  Z'= -2x1+x2    Subject to   3x1-2x2=4  x1+4x2=7  x1,x2≥0 |
| Option B: | Maximise Z'= 2x1-x2    Subject to   3x1-2x2+s1=4  x1+4x2+s2=7  x1,x2,s1,s2≥0 |
| Option C: | MaximiseZ'= 2x1-x2    Subject to   3x1-2x2+s1=4  x1+4x2+s2=7  x1,x2,s1,s2≥0 |
| Option D: | MaximiseZ'= 2x1-x2    Subject to  -3x1+2x2+s1=4  x1+4x2+s2=7  x1,x2,s1,s2≥0 |
|  |  |
| 58. | If 3, 3 0 0 3 , 3 0 0 0 3 0 0 0 3 are the principal minor determinants of Hessian matrix at X0, then X0 is a |
| Option A: | Minima |
| Option B: | Maxima |
| Option C: | Saddle point |
| Option D: | No conclusion |
|  |  |
| 59. | If  the objective function of NLLP is maximization type, then in Kuhn-Tucker conditions is |
| Option A: | λ=0 |
| Option B: | λ<0 |
| Option C: | λ≥0 |
| Option D: | is not defined |
|  |  |
| 60. | The value of  Lagrange’s multiplier for the following NLPP is  Optimise  Z=7x12+5x22  Subject to 2x1+5x2=7  x1,x2≥0 |
| Option A: | λ=49/39 |
| Option B: | λ=14/36 |
| Option C: | λ=98/39 |
| Option D: | λ=39/64 |

**Descriptive Questions**

| 1 | In an exam taken by 800 candidates, the average and standard deviation of marks obtained (normally distributed) are 40% and 10% respectively. What should be the minimum score if 350 candidates are to be declared as passed |
| --- | --- |
| 2 | If A= , By using Cayley-Hamilton theorem find the matrix represented by |
| 3 | Evaluate the following integral using Cauchy-Residue theorem.  where c is the circle |
| 4 | Obtain inverse z-transform |
| 5 | Solve by the Simplex method  Maximize  Subject to |
| 6 | Using Lagrange’s multipliers solve the following NLPP  Optimise  Subject to |
| 7 | By using Cayley-Hamilton theorem find  and  where |
| 8 | Evaluate  along the path (i), (ii). Is the line integral independent of the path? |
| 9 | Find the Z-transform of |
| 10 | A car hire firm has two 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 proportion of day on which i) neither car is used ii) some demand is refused. |
| 11 | Find the dual of the following LPP  Maximize  Subject to ; ;  unrestricted. |
| 12 | Using the method of Lagrange’s multiplier solve the following NLPP  Optimize  Subject to ; |
| 13 | Find the Eigen values and Eigen vectors of |
| 14 | Evaluate using Cauchy’s residue theorem. |
| 15 | Find the Z transform of |
| 16 | A certain drug administered to 12 patients resulted in the following change in their blood pressure.  5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4  Can we conclude that the drug increases the blood pressure ? |
| 17 | Solve the following LPP by simplex method |
| 18 | Solve the following NLPP using Kuhn-Tucker conditions |
| 19 | When the first proof of 392 pages of a book of 1200 pages were read, the distribution of printing mistakes were found to be as follows.   | No of mistakes in page (X) | 0 | 1 | 2 | 3 | 4 | | --- | --- | --- | --- | --- | --- | | No. of pages (f) | 275 | 72 | 30 | 7 | 5 |   Fit a poisson distribution to the above data and test the goodness of fit. |
| 20 | Show that the matrix is not diagonalizable. |
| 21 | If obtain Taylor’s and Laurent’s series expansions of f(z) in the domain & respectively. |
| 22 | If find |
| 23 | Solve using dual simplex method  Minimize  Subject to |
| 24 | Solve following NLPP using Kuhn-Tucker method  Maximize  Subject to |
| 25 | Find the eigen values and eigen vectors of |
| 26 | Evaluate by Cauchy’s residue theorem ; where |
| 27 | Find the inverse z-transforms of ; |
| 28 | In an examination marks obtained by students in Mathematics, Physics and Chemistry are normally distributed with means 51, 53 and 46 with standard deviation 15, 12, 16 respectively. Find the probability of securing total marks i) 180 or above, ii) 80 or below |
| 29 | Using Simplex method solve the following LPP  Maximize  Subject to    ; |
| 30 | Solve the following NLPP by using Kuhn-Tucker conditions:  Maximize  Subject to |
| 31 | Verify Cayley-Hamilton theorem for the matrix  Hence compute |
| 32 | Evaluate |
| 33 | Find the inverse Z transform of |
| 34 | In a competitive examination the top 15% of the students appeared will get grade A, while the bottom 20% will be declared fail. If the grades are normally distributed with mean % of marks 65 and S.D. 10, determine the lowest % of marks to receive grade A. |
| 35 | Write the dual of the following LPP  is unrestricted. |
| 36 | Using Lagrange’s multipliers solve |