Index- Engineering Mathematics

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Linear Algebra

1) The determinant of the matrix
$$\begin{bmatrix} 2 & 0 & 0 & 0 \\ 8 & 1 & 7 & 2 \\ 2 & 0 & 2 & 0 \\ 9 & 0 & 6 & 1 \end{bmatrix}$$ is

1 Marks GATE-CSE/IT-2000( )

[A] 4 | [B] 0
[C] 15 | [D] 20

2) Consider the following set of equations:
x + 2y = 5
4x + 8y = 12
3x + 6y + 3z = 15
This set

1 Marks GATE-CSE/IT-1998( )

[A] has unique solution
[B] has no solutions
[C] has finite number of solutions
[D] has infinite number of solutions

3) Let a= (a_{ij}) be an n-rowed square matrix and I_{12} be the matrix obtained by interchanging the first and second rows of the n-rowed Identify matrix. Then AI_{12} is such that its first

2 Marks GATE-CSE/IT-1997( )

[A] row is the same as its second row
[B] row is the same as the second row of A
[C] column is the same as the second column of A
[D] row is all zero

4) Let Ax = b be a system of linear equations where A is an m × n matrix and b is a m × 1 column vector and X is a n × 1 column vector of unknows. Which of the following is false?

1 Marks GATE-CSE/IT-1996( )

[A] The system has a solution if and only if, both A and the augmented matrix [A b] have the same rank.
[B] If m <n and b is the zero vector, then the system has infinitely many solutions.
[C] If m = n and b is non-zero vector, then the system has a unique solution.
[D] The system will have only a trivial solution when m = n, b is the zero vector and rank (A) = n.

5) The matrices $\begin{bmatrix} cos\theta & sin\theta \\ sin\theta & cos\theta \end{bmatrix}$ and $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$ commute under multiplication

2 Marks GATE-CSE/IT-1996( )

[A] if a = b or θ = nπ, is an integer
[B] always
[C] never
[D] if a cos θ ≠ b sin θ

6) _The rank of the following (_n_+_1)_×(_n_+_1)_matrix, where a is a real number is
$$\begin{bmatrix} 1 & a & a^2 & \dots & a^n \\ 1 & a & a^2 & \dots & a^n \\ 1 & a & a^2 & \dots & a^n \\ .. & .. & .. & .. & .. \\ 1 & a & a^2 & .. & a^n \end{bmatrix}$$
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1 Marks GATE-CSE/IT-1995( )

[A] 1
[B] 2
[C] n
[D] Depends on the value of a

7) A unit vector perpendicular to both the vectors a = 2i − 2 j + k and b = 1 + j − 2k is:

2 Marks GATE-CSE/IT-1995( )

[A] $\frac{1}{\sqrt{3}}$ (i+j+k)
[B] 1 / 3 (i+j-k)
[C] 1 / 3 (i-j-k)
[D] $\frac{1}{\sqrt{3}}$ (i+j-k)

8) Let A and B be real symmetric matrices of size n × n . Then which one of the following is true?

1 Marks GATE-CSE/IT-1994( )

[A] $AA^T = I$
[B] $A = -A^T$
[C] AB = BA
[D] $(AB)^T = BA$

9) The rank of matrix $\begin{bmatrix} 0 & 0 & -3 \\ 9 & 3 & 5 \\ 3 & 1 & 1 \end{bmatrix}$ is

1 Marks GATE-CSE/IT-1994( )

[A] 0 [B] 1
[C] 2 [D] 3

10) In a compact single dimensional array representation for lower triangular matrices (i.e all the elements above the diagonal are zero) of size n $\times$ n, non zero elements (i.e elements of the lower triangle) of each row are stored one after another, starting from the first row, the index of the (i, j)th triangular matrix in this new representation is: element

1 Marks GATE-CSE/IT-1994( )

[A] i+j [B] i+j-1
[C] j+ i(i-1)/2 [D] i+j(j-1)/2

11) The eigen vector(s) of the matrix
$\begin{bmatrix} 0 & 0 & \alpha \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$, $\alpha \neq 0$ is (are)

1 Marks GATE-CSE/IT-1993( )

[A] (0,0,α) [B] (α, 0 , 0)
[C] (0,0,1) [D] (0,α,0)

12) Consider the following system of linear equations

$$\begin{bmatrix} 2 & 1 & -4 \\ 4 & 3 & -12 \\ 1 & 2 & -8 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \alpha \\ 5 \\ 7 \end{bmatrix}$$

Notice that the second and the third columns of the coefficient matrix are linearly dependent . For how many values of α, does this system of equations have infinity many solutions?

2 Marks GATE-CSE/IT-2003( )

[A] 0 [B] 1
[C] 2 [D] Infinity many

13) The eigen vector(s) of the matrix $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ $, a \neq 0$, is/are

2 Marks GATE-ECE/TCE-1993( )

[A] $(0, 0, \alpha)$ [B] $(\alpha, 0, 0)$
[C] $(0, 0, 1)$ [D] $(0, \alpha, 0)$

14) The matrix $[A] = \begin{bmatrix} 2 & 1 \\ 4 & -1 \end{bmatrix}$ is decomposed into a product of a lower triangular matrix [L] and an upper triangular matrix [U]. The properly decomposed [L] and [U] matrices respectively are

2 Marks GATE-EEE-2011( )

[A] $\begin{bmatrix} 1 & 0 \\ 4 & -1 \end{bmatrix}$ *and* $\begin{bmatrix} 1 & 1 \\ 0 & -2 \end{bmatrix}$ [B] $\begin{bmatrix} 2 & 0 \\ 4 & -1 \end{bmatrix}$ *and* $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$
[C] $\begin{bmatrix} 1 & 0 \\ 4 & 1 \end{bmatrix}$ *and* $\begin{bmatrix} 2 & 1 \\ 0 & -1 \end{bmatrix}$ [D] $\begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$ $\begin{bmatrix} 2 & 1 \\ 0 & -3 \end{bmatrix}$

15) A Matrix has eigenvalues -1 and -2. The corresponding eigenvectors are $\begin{bmatrix} 1 \\ -1 \end{bmatrix}$ and $\begin{bmatrix} 1 \\ -2 \end{bmatrix}$ respectively. The matrix is

2 Marks GATE-EEE-2013( )

[A] $\begin{bmatrix} 1 & 1 \\ -1 & -2 \end{bmatrix}$ [B] $\begin{bmatrix} 1 & 2 \\ -2 & -4 \end{bmatrix}$
[C] $\begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix}$ [D] $\begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$

16) Roots of the algebraic equation $X^3 + X^2 + X + 1 = 0$ are

1 Marks GATE-EEE-2011( )

[A] $X^3 + X^2 + X + 1 = 0$ [B] (-1, -j, +j)
[C] $(+1, -1, +1)$ [D] $(0, 0, 0)$

17) A cubic polynomial with real coefficients

2 Marks GATE-EEE-2009( )

[A] can possibly have no extrema and no zero crossings

[B] may have up to three extrema and up to 2 zero crossings

[C]cannot have more than two extrema and more than three zero crossings

[D]will always have an equal number of extrema and zero crossings

18) The trace and determinant of a 2 ´ 2 matrix are known to be –2 and –35 respectively. Its eigen values are

2 Marks GATE-EEE-2009( )

[A] –30 and –5

[B] –37 and –1

[C] –7 and 5

[D] 17.5 and –2

19) The determinant of the matrix $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 100 & 1 & 0 & 0 \\ 100 & 200 & 1 & 0 \\ 100 & 200 & 300 & 1 \end{bmatrix}$ is

2 Marks GATE-EEE-2002( )

[A] 100

[B] 200

[C]1

[D]300

20) A set of linear equations is represented by the matrix equation Ax=b. the necessary condition for the existence of a solution for this system is:

2 Marks GATE-EEE-1998( )

[A] A must be invertible

[B] b must be linearly depended on the columns of A

[C]b must be linearly independent of the columns of A

[D]None of the above

21) The vector $\begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$ is an eigen vector of $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ .One of the given values A is

2 Marks GATE-EEE-1998( )

[A] 1

[B] 2

[C]5

[D]–1

22) $A = \begin{bmatrix} 2 & 0 & 0 & -1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ -1 & 0 & 0 & 4 \end{bmatrix}$ sum of the eigen values of the matrix A is:

2 Marks GATE-EEE-1998( )

[A] 10

[B] -10

[C]24

[D]22

23) $A = \begin{bmatrix} 5 & 0 & 2 \\ 0 & 3 & 0 \\ 2 & 0 & 1 \end{bmatrix}$. The inverse of A is:

2 Marks GATE-EEE-1998( )

[A] $\begin{bmatrix} 1 & 0 & -2 \\ 0 & \frac{1}{3} & 0 \\ -2 & 0 & 5 \end{bmatrix}$

[B] $\begin{bmatrix} 5 & 0 & 2 \\ 0 & \frac{-1}{3} & 0 \\ 2 & 0 & 1 \end{bmatrix}$

[C] $\begin{bmatrix} \frac{1}{5} & 0 & \frac{1}{2} \\ 0 & \frac{1}{3} & 0 \\ \frac{1}{2} & 0 & 1 \end{bmatrix}$

[D] $\begin{bmatrix} \frac{1}{5} & 0 & \frac{-1}{2} \\ 0 & \frac{1}{3} & 0 \\ \frac{-1}{2} & 0 & 1 \end{bmatrix}$

24) A square matrix IS called singular, if its

2 Marks GATE-EEE-1997( )

[A] determinan t is unity

[B] determinant is zero

[C]determinantt is infinity

[D]rank is unity

25) The inverse of the matrix $S = \begin{bmatrix} 1 & -1 & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ IS

2 Marks GATE-EEE-1995( )

[A] $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix}$

[B] $\begin{bmatrix} 0 & 1 & 1 \\ -1 & -1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$

[C]$\begin{bmatrix} 2 & 2 & -2 \\ -2 & 2 & -2 \\ 0 & 2 & 2 \end{bmatrix}$

[D]$\begin{bmatrix} \frac{1}{2} & \frac{1}{2} & \frac{-1}{2} \\ \frac{-1}{2} & \frac{1}{2} & \frac{-1}{2} \\ 0 & 0 & 1 \end{bmatrix}$

26) A 5×7 matrix has all its entries equal to -a.the rank of the matrix is

2 Marks GATE-EEE-1994( )

[A] 7

[B] 5

[C]1

[D]zero

27) The eigen values of the matrix $\begin{bmatrix} a & 1 \\ a & 1 \end{bmatrix}$ are

2 Marks GATE-EEE-1994( )

[A](a+1),0

[B] a,0

[C](a-1),0

[D]0,0

28) The inverse of the matrix $\begin{bmatrix} 3+2i & i \\ -i & 3-2i \end{bmatrix}$ is

2 Marks GATE-CE-2010( )

[A] $\frac{1}{12}\begin{bmatrix} 3+2i & -i \\ i & 3-2i \end{bmatrix}$

[B] $\frac{1}{12}\begin{bmatrix} 3-2i & -i \\ i & 3+2i \end{bmatrix}$

[C] $\frac{1}{14}\begin{bmatrix} 3+2i & -i \\ i & 3-2i \end{bmatrix}$

[D] $\frac{1}{14}\begin{bmatrix} 3-2i & -i \\ i & 3+2i \end{bmatrix}$

29) The eigenvalues of matrix $\begin{bmatrix} 9 & 5 \\ 5 & 8 \end{bmatrix}$ are

2 Marks GATE-CE-2012( )

[A] -2.42 and 6.86

[B] 3.48 and 13.53

[C]4.70 and 6.86

[D]6.86 and 9.50

30)[A] is a square matrix which is neither symmetric nor skew-symmetric and [A]T is its transpose. The sum and difference of these matrices are defined as [S] = [A] + [A]T and [D] = [A] - [A]T, respectively. Which of the following statements is TRUE?

1 Marks GATE-CE-2011( )

[A] Both [S] and [D] are symmetric

[B] Both [S] and [D] are skew-symmetric

[C][S] is skew-symmetric and [D] is symmetric

[D][S] is symmetric and [D] is skew-symmetric

31) If $\vec{a}$ and $\vec{b}$ are two arbitrary vectors. with magnitudes a and b, respectively, $\left|\vec{a} \times \vec{b}\right|^2$ will be equal to

2 Marks GATE-CE-2011( )

[A] $a^2b^2 - (\vec{a}.\vec{b})^2$

[B] $ab - \vec{a}.\vec{b}$

[C] $a^2b^2 + (\vec{a}.\vec{b})^2$

[D] $ab + \vec{a}.\vec{b}$

32) A square matrix B is skew-symmetric if

1 Marks GATE-CE-2009( )

[A] $B^T = -B$

[B] $B^T = B$

[C] $B^{-1} = B$

[D] $B^{-1} = B^T$

33) For a scalar function $f(x, y, z) = x^2 + 3y^2 + 2z^2$, the gradient at the point P(1, 2, -1) is

1 Marks GATE-CE-2009( )

[A] $2\bar{i} + 6\bar{j} + 4\bar{k}$

[B] $2\bar{i} + 12\bar{j} - 4\bar{k}$

[C] $2\bar{i} + 12\bar{j} + 4\bar{k}$

[D] $\sqrt{56}$

34) Solution for the system defined by the set of equations 4y+3z=8; 2x-z=2; and 3x+2y=5 is

1 Marks GATE-CE-2006( )

[A] x=0; y=1; z=4/3

[B] x=0; y=1/2; z=2

[C]x=1; y=1/2; z=2

[D]nonexistent

35) The product of matrices $(PQ)^{-1}P$ is

1 Marks GATE-CE-2008( )

[A] P^{-1}

[B] Q^{-1}

[C] $P^{-1}Q^{-1}$

[D] PQP^{-1}

36) For a scalar function $f(x, y, z) = x^2 + 3y^2 + 2z^2$, the directional derivative at the point P(1, 2, -1) in the direction of a vector $\vec{i} - \vec{j} + 2\vec{k}$ is

2 Marks GATE-CE-2009( )

[A] -18

[B] $-3\sqrt{6}$

[C] $3\sqrt{6}$

[D]18

37) For a given matrix $\begin{bmatrix} 2 & -2 & 3 \\ -2 & -1 & 6 \\ 1 & 2 & 0 \end{bmatrix}$, one of the eigenvalues is 3.The other two eigenvalues are

2 Marks GATE-CE-2006( )

[A] 2,- 5 [B] 3, -5

[C] 2, 5 [D] 3, 5

38) The directional derivative of f(x ,y, z) = $2x^2 + 3y^2 + z^2$ at the point P: (2, 1, 3) in the direction of the vector a = i-2 k is

2 Marks GATE-CE-2006( )

[A] -2.785 [B] - 2.145

[C] - 1.789 [D] 1.000

39) The Eigen values of the matrix $[p] = \begin{bmatrix} 4 & 5 \\ 2 & -5 \end{bmatrix}$ are

2 Marks GATE-CE-2008( )

[A] -7 and 8 [B] -6 and 5

[C] 3 and 4 [D] 1 and 2

40) Consider the matrices $X_{(4,3)}$, $Z_{(2,3)}$ and $Y_{(4,3)}$.
The order of $[P(X^TY)^{-1}P^T]^T$ will be

1 Marks GATE-CE-2005( )

[A] (2×2) [B] (3×3)

[C] (4×3) [D] (3×4)

41) Consider a non-homogeneous system of linear equations representing mathematically an over-determined system. Such a system will be

1 Marks GATE-CE-2005( )

[A] consistent having a unique solution [B] consistent having a many solutions

[C] inconsistent having a unique solution [D] inconsistent having no solution

42) The following simultaneou s equations
x+yz=3
x+2y+3z=4
x+4y+kz=6
will NOT have a uniqu e solution fork equal to

2 Marks GATE-CE-2008( )

[A] 0 [B] 30

[C] 6 [D] 7

43) The inner (dot) product of two vectors $\overline{P}$ and $\overline{Q}$ is zero. The angle (degrees) between the two vectors is

2 Marks GATE-CE-2008( )

[A] 0 [B] 5

[C] 90 [D] 120

44) The minimum and the maximum eigen values of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ are -2 and 6, respectively. What is the other eigen value?

1 Marks GATE-CE-2007( )

[A] 5 [B] 3

[C] 1 [D] -1

45) For what values of α and β the following simultaneous equations have an infinite number of solutions?
$x + y + z = 5;$ $x + 3y + +3z = 9; x + 2y + +\alpha z = \beta;$

2 Marks GATE-CE-2007( )

[A] 2,7 [B] 3,8

[C] 8,3 [D] 72

46) A velocity vector is given as
$\vec{v} = 5xy\vec{i} + 2y^2\vec{j} + 3yz^2\vec{k}$ The divergence of this velocity vector at (1,1,1) is

2 Marks GATE-CE-2007( )

[A] 9 [B] 10

[C] 14 [D] 15

47) The inverse of the 2 x 2 matrix $\begin{bmatrix} 1 & 2 \\ 5 & 7 \end{bmatrix}$ is

2 Marks GATE-CE-2007( )

[A] $\frac{1}{3}\begin{bmatrix} -7 & 2 \\ 5 & -1 \end{bmatrix}$
[B] $\frac{1}{3}\begin{bmatrix} 7 & 2 \\ 5 & 1 \end{bmatrix}$
[C] $\frac{1}{3}\begin{bmatrix} 7 & -2 \\ -5 & 1 \end{bmatrix}$
[D] $\frac{1}{3}\begin{bmatrix} -7 & -2 \\ -5 & -1 \end{bmatrix}$

48) Given that one root of the equation $x^3 - 10x^2 + 31x - 30 = 0$ is 5, the other two roots are

2 Marks GATE-CE-2007( )

[A] 2 and 3
[B] 2 and 4
[C] 3 and 4
[D] -2 and -3

49) If A and B are two ma trices and if AB exists, then BA exists

2 Marks GATE-CE-1997( )

[A] if A has as many rows as B has columns
[B] only if both A and B are square matrices
[C] only if A and B are skew matrices
[D] only if both A and B are symmetric

50) If the determinant of the matrix $\begin{bmatrix} 1 & 3 & 2 \\ 0 & 5 & -6 \\ 2 & 7 & 8 \end{bmatrix}$ is 26, then the determinant of the matrix $\begin{bmatrix} 2 & 7 & 8 \\ 0 & 5 & -6 \\ 1 & 3 & 2 \end{bmatrix}$ is

2 Marks GATE-CE-1997( )

[A] -26
[B] 26
[C] 0
[D] 52

51) Real matrix $[A]_{3\times1}$, $[B]_{3\times3}$, $[C]_{3\times5}$, $[D]_{5\times3}$, $[E]_{5\times5}$ and $[F]_{5\times1}$ are given. Matrices [B] and [E] are symmetric.
Following statements are made with respect to these matrices.
I. Matrix product $[F]^T[C]^T[B][C][F]$ is a scalar
II. Matrix product $[D]^T[F][D]$ is always symmetric
With reference to above statements, which of the following applies?

1 Marks GATE-CE-2004( )

[A] Statement I is true but II is false
[B] Statement I is false but II is true
[C] Both the statements are true
[D] Both the statements are false

52) The eigenvalues of the matrix $\begin{bmatrix} 4 & -2 \\ -2 & 1 \end{bmatrix}$

2 Marks GATE-CE-2004( )

[A] are 1 and 4
[B] are -1 and 2
[C] are 0 and 5
[D] cannot be determined

53) Consider the system of equations
$A_{(m\times n)}X_{(-1xt)} = 1_{(n\times1)}$, where, 1 is a scalar.
Let (l_i, X_i) be an eigen-pair of an eigen value and its corresponding eigen vector for real matrix A. Let I be a (n' n) unit matrix. Which one of the following statement is NOT correct?

2 Marks GATE-CE-2005( )

[A] For a homogeneous $n \times n$ system of linear equations, (A-lI) x= 0 having a nontrivial solution, the rank of (A-lI) is less than n.
[B] For matrix A^m, m being a positive integer, (λ_i^m, X_i^m) will be the eigen-pair for all i
[C] If $A^T = A^{-1}$, then $|1_i| = 1$ for all i
[D] If $A^T = A$, then 1_i is for all i

54) Given Matrix $[A] = \begin{bmatrix} 4 & 2 & 1 & 3 \\ 6 & 3 & 4 & 7 \\ 2 & 1 & 0 & 1 \end{bmatrix}$, the rank of the matrix is

1 Marks GATE-CE-2003( )

[A] 4
[B] 3
[C] 2
[D] 1

55) Determinant of the following matrix is $\begin{bmatrix} 5 & 3 & 2 \\ 1 & 2 & 6 \\ 3 & 5 & 10 \end{bmatrix}$

2 Marks GATE-CE-2001( )

[A] -76
[B] -28
[C] +28
[D] +72

56) If, A, B, C are square matrices of the same order, $(ABC)^{-1}$ is equal to

1 Marks GATE-CE-2000( )

[A] $C^{-1}A^{-1}B^{-1}$
[B] $C^{-1}B^{-1}A^{-1}$
[C] $A^{-1}B^{-1}C^{-1}$
[D] $A^{-1}C^{-1}B^{-1}$

57) The product $[P][Q]^T$ of the following two matrices [P] and [Q] is
$[P] = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$; $[Q] = \begin{bmatrix} 4 & 8 \\ 9 & 2 \end{bmatrix}$

2 Marks GATE-CE-2001( )

[A] $\begin{bmatrix} 32 & 24 \\ 56 & 46 \end{bmatrix}$
[B] $\begin{bmatrix} 46 & 56 \\ 24 & 32 \end{bmatrix}$
[C] $\begin{bmatrix} 35 & 22 \\ 61 & 42 \end{bmatrix}$
[D] $\begin{bmatrix} 32 & 56 \\ 24 & 46 \end{bmatrix}$

58) The given values of the matrix $\begin{bmatrix} 5 & 3 \\ 2 & 9 \end{bmatrix}$ are

2 Marks GATE-CE-2001( )

[A](5.13, 9.42)
[B](3.85, 2.93)
[C](9.00, 5.00)
[D](10.16, 3.84)

59) Consider the following two statements:
I. The maximum number of linearly independent column vectors of a matrix A is called the rank of A.
II. If A is an $n \times n$ square matrix, it will be non singular is rank A = n.
With reference to the above statements, which of the following applies ?

1 Marks GATE-CE-2000( )

[A] Both the statements are false
[B] Both the statements are true
[C] I is true but II is false
[D] I is false but II is true.

60) If A is any n x n matrix and k is a scalar, $|kA| = \alpha |A|$, where α is

2 Marks GATE-CE-1999( )

[A] k/n
[B] k^n
[C] n^k
[D] kn

61) Inverse of matrix $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ is

1 Marks GATE-CE-1997( )

[A] $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$
[B] $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$
[C] $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
[D] $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

62) If A is a real square matrix, then AA^T is

1 Marks GATE-CE-1998( )

[A] Unsymmetric
[B] always symmetric
[C] Skew-symmetric
[D] Some times symmetric

63) In matrix algebra AS = AT (A, 5, T, a re matrices of appropriate order) implies S=T only if

1 Marks GATE-CE-1998( )

[A] A is symmetric
[B] A is singular
[C] A is non singular
[D] A is skew symmetric

64) The real symmetric matrix C corresponding to the Quadratic form $Q = 4x_1x_2 - 5x_{22}.\ is$

2 Marks GATE-CE-1998( )

[A] $\begin{bmatrix} 1 & 2 \\ 2 & -5 \end{bmatrix}$
[B] $\begin{bmatrix} 2 & 0 \\ 0 & -5 \end{bmatrix}$
[C] $\begin{bmatrix} 1 & 1 \\ 1 & -2 \end{bmatrix}$
[D] $\begin{bmatrix} 0 & 2 \\ 1 & -5 \end{bmatrix}$

65) One pair of eigen vectors corresponding to the two eigenvalues of the matrix $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ is

2 Marks GATE-EIN/IN-2013( )

[A] $\begin{bmatrix} j \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ -j \end{bmatrix}$
[B] $\begin{bmatrix} 0 \\ 1 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \end{bmatrix}$
[C] $\begin{bmatrix} 1 \\ j \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix}$
[D] $\begin{bmatrix} 1 \\ j \end{bmatrix}, \begin{bmatrix} j \\ 1 \end{bmatrix}$

66) Given that $A = \begin{bmatrix} -5 & -3 \\ 2 & 0 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, the value of A^3 is

2 Marks GATE-EIN/IN-2012( )

[A] 15A+12I | [B] 19A+30I
[C] 17A+15I | [D] 17A+21I

67) The eigenvalues of a (2x2) matrix X are –2 and –3. The eigenvalues of matrix $(X+I)^{-1}$ (X+5I) are

2 Marks GATE-EIN/IN-2009( )

[A] –3,–4 | [B] –1,–2
[C] –1,–3 | [D] –2,–4

68) The matrix $P = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$ rotates a vector about the axis $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ by an angle of

2 Marks GATE-EIN/IN-2009( )

[A] 30^0 | [B] 60^0
[C] 90^0 | [D] 120^0

69) The rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \\ 4 & 6 & 8 \end{bmatrix}$, is

1 Marks GATE-EIN/IN-2000( )

[A] 0 | [B] 1
[C] 2 | [D] 3

70) For a singular matrix.

2 Marks GATE-EIN/IN-2000( )

[A] Atleast one eigen value would be at the origin | [B] All eigen values would be at the origin
[C] No eigen value would be at the origin. | [D] None

71) Identify which one of the following is an eigenvector of the matrix

$A = \begin{bmatrix} 1 & 0 \\ -1 & -2 \end{bmatrix}$

1 Marks GATE-EIN/IN-2005( )

[A] $\begin{bmatrix} -1 & 1 \end{bmatrix}^T$ | [B] $\begin{bmatrix} 3 & -1 \end{bmatrix}^T$
[C] $\begin{bmatrix} 1 & -1 \end{bmatrix}^T$ | [D] $\begin{bmatrix} -2 & 1 \end{bmatrix}^T$

72) For a given 2×2 matrix A, it is observed that

$A \begin{bmatrix} 1 \\ -1 \end{bmatrix} = - \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ and $A \begin{bmatrix} 1 \\ -2 \end{bmatrix} = -2 \begin{bmatrix} 1 \\ -2 \end{bmatrix}$

Then matrix A is

2 Marks GATE-EIN/IN-2006( )

[A] $A = \begin{bmatrix} 2 & 1 \\ -1 & -1 \end{bmatrix} \begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ -1 & -2 \end{bmatrix}$ | [B] $A = \begin{bmatrix} 1 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ -1 & -1 \end{bmatrix}$
[C] $A = \begin{bmatrix} 1 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ -1 & -1 \end{bmatrix}$ | [D] $A = \begin{bmatrix} 0 & -2 \\ 1 & -3 \end{bmatrix}$

73) Let $A = [a_{ij}], 1 \le i, j \le n$, with $n \ge 3$ and $a_{ij} = i.j$. Then the rank of A is

2 Marks GATE-EIN/IN-2007( )

[A] 0 | [B] 1
[C] n–1 | [D] n

74) Rank of the matrix given below is

$\begin{bmatrix} 3 & 2 & -9 \\ -6 & -4 & 18 \\ 12 & 8 & -36 \end{bmatrix}$

1 Marks GATE-ME-1999( )

[A] 1 | [B] 2
[C] 3 | [D] $\sqrt{2}$

75) Given the matrix $\begin{bmatrix} -4 & 2 \\ 4 & 3 \end{bmatrix}$, the eigen vector is

2 Marks GATE-ECE/TCE-2005( )

[A] $\begin{bmatrix} 3 \\ 2 \end{bmatrix}$ | [B] $\begin{bmatrix} 4 \\ 3 \end{bmatrix}$
[C] $\begin{bmatrix} 2 \\ -1 \end{bmatrix}$ | [D] $\begin{bmatrix} -1 \\ 2 \end{bmatrix}$

76) Let $A = \begin{bmatrix} 2 & -0.1 \\ 0 & 3 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1/2 & a \\ 0 & b \end{bmatrix}$. Then (a+b) =

2 Marks GATE-ECE/TCE-2005( )

[A] 7/20 [B] 3/20

[C] 19/20 [D] 11/20

77) Given an orthogonal matrix $A = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & 1 & -1 \end{bmatrix}$, then the value of $[AA^T]^{-1}$ is

2 Marks GATE-ECE/TCE-2005( )

[A] $\begin{bmatrix} \frac{1}{4} & 0 & 0 & 0 \\ 0 & \frac{1}{4} & 0 & 0 \\ 0 & 0 & \frac{1}{2} & 0 \\ 0 & 0 & 0 & \frac{1}{2} \end{bmatrix}$ [B] $\begin{bmatrix} \frac{1}{2} & 0 & 0 & 0 \\ 0 & \frac{1}{2} & 0 & 0 \\ 0 & 0 & \frac{1}{2} & 0 \\ 0 & 0 & 0 & \frac{1}{2} \end{bmatrix}$

[C] $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ [D] $\begin{bmatrix} \frac{1}{4} & 0 & 0 & 0 \\ 0 & \frac{1}{4} & 0 & 0 \\ 0 & 0 & \frac{1}{4} & 0 \\ 0 & 0 & 0 & \frac{1}{4} \end{bmatrix}$

78) The rank of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ is

2 Marks GATE-ECE/TCE-2006( )

[A] 0 [B] 1

[C] 2 [D] 3

79) The Eigen values and the corresponding Eigen vectors of a 2 x 2 matrix are given by

Eigen value	Eigen vector
$\lambda_1 = 8$	$V_1 \begin{bmatrix} 1 \\ 1 \end{bmatrix}$
$\lambda_2 = 4$	$V_2 \begin{bmatrix} 1 \\ -1 \end{bmatrix}$

The matrix is

2 Marks GATE-ECE/TCE-2006( )

[A] $\begin{bmatrix} 6 & 2 \\ 2 & 6 \end{bmatrix}$ [B] $\begin{bmatrix} 4 & 6 \\ 6 & 4 \end{bmatrix}$

[C] $\begin{bmatrix} 2 & 4 \\ 4 & 2 \end{bmatrix}$ [D] $\begin{bmatrix} 4 & 8 \\ 8 & 4 \end{bmatrix}$

80) For the matrix $\begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix}$ the given value corresponding to the eigen vector $\begin{bmatrix} 101 \\ 101 \end{bmatrix}$ is

2 Marks GATE-ECE/TCE-2006( )

[A] 2 [B] 4

[C] 6 [D] 8

81) It is given that $X_1, X_2 \ldots X_M$ are M non-zero orthogonal vectors. The dimension of the vector space spanned by the 2M vectors $X_1, X_2 \ldots X_M, -X_1, -X_2 \ldots\ldots -X_M$ is

2 Marks GATE-ECE/TCE-2007( )

[A] 2M [B] M + 1

[C] M [D] dependent on the choice of $X_1, X_2 \ldots X_M$

82) All the four entries of the 2 x 2 matrix $P = \begin{bmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{bmatrix}$ are nonzero, and one of its eigen values is zero. Which of the following statements is true?

2 Marks GATE-ECE/TCE-2008( )

[A] $P_{11}P_{22} - P_{12}P_{21} = 1$ [B] $P_{11}P_{22} - P_{12}P_{21} = -1$

[C] $P_{11}P_{22} - P_{12}P_{21} = 0$ [D] $P_{11}P_{22} + P_{12}P_{21} = 0$

83) The system of linear equations

$4x + 2y = 7$

$2x + y = 6$

has

2 Marks GATE-ECE/TCE-2008( )

[A] A unique solution [B] No solution

[C] An infinite number of solutions [D] Exactly two distinct solutions

84) $P = \begin{bmatrix} 0 & 1 \end{bmatrix}$

Consider the matrix The value of e^{P} is

2 Marks GATE-ECE/TCE-2008( )

[A] $\begin{bmatrix} 2e^{-2}-3e^{-1} & e^{-1}-e^{-2} \\ 2e^{-2}-2e^{-1} & 5e^{-2}-e^{-1} \end{bmatrix}$ [B] $\begin{bmatrix} e^{-1}+e^{-2} & 2e^{-2}-e^{-1} \\ 2e^{-1}-4e^{-2} & 3e^{-1}+2e^{-2} \end{bmatrix}$

[C] $\begin{bmatrix} 5e^{-2}-e^{-1} & 3e^{-1}-e^{-2} \\ 2e^{-2}-6e^{-1} & 4e^{-2}+e^{-1} \end{bmatrix}$ [D] $\begin{bmatrix} 2e^{-1}-e^{-2} & e^{-1}-e^{-2} \\ -2e^{-1}+2e^{-2} & -e^{-1}+2e^{-2} \end{bmatrix}$

85) The eigen values of the following matrix are $\begin{bmatrix} -1 & 3 & 5 \\ -3 & -1 & 6 \\ 0 & 0 & 3 \end{bmatrix}$

2 Marks GATE-ECE/TCE-2009( )

[A] 3, 3 + 5j, 6−j [B] −6, + 5j, 3 + j, 3−j

[C] 3 + j, 3−j, 5 + j [D] 3, −1 + 3j, −1−3j

86) In the matrix equation Px = q, which of the following is a necessary condition for the existence of at least one solution for the unknown vector x

2 Marks GATE-EEE-2005( )

[A] Augmented matrix [Pq] must have the same rank as matrix P [B] Vector q must have only non-zero elements

[C] Matrix P must be singular [D] Matrix P must be square

87) For the matrix P = $\begin{bmatrix} 3 & -2 & 2 \\ 0 & -2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ one of the eigen values is equal to −2. which of the following is an eigen vector?

2 Marks GATE-ECE/TCE-2005( )

[A] $\begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix}$ [B] $\begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix}$

[C] $\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$ [D] $\begin{bmatrix} 2 \\ 5 \\ 0 \end{bmatrix}$

88) If R = $\begin{bmatrix} 1 & 0 & -1 \\ 2 & 1 & -1 \\ 2 & 3 & 2 \end{bmatrix}$, then top row of R^{-1} is

2 Marks GATE-EEE-2005( )

[A] [5 6 4] [B] [5 −3 1]

[C] [2 0 −1] [D] [2 −1 1/2]

89) $x = [x_1\ x_2 \ldots x_n]^T$ is an n-tuple nonzero vector. The n x n matrix $V = xx^T$

2 Marks GATE-EEE-2007( )

[A] Has rank zero [B] Has rank 1

[C] Is orthogonal [D] Has rank n

90) A loaded dice has following probability distribution of occurrences

Dice value	1	2	3	4	5	6
Probability	¼	1/8	1/8	1/8	1/8	1/4

If three identical dice as the above are thrown, the probability of occurrence of values 1, 5 and 6 on the three dice is

2 Marks GATE-EEE-2007( )

[A] Same as that of occurrence of 3, 4, 5
[B] Same as that of occurrence of 1,2,5
[C] 1 / 128
[D] 5 / 8

91) Let x and y be two vectors in a 3 dimensional space and <x,y> denote their dot product. Then the determinant

$$\det \begin{bmatrix} <x,x> & <x,y> \\ <y,x> & <y,y> \end{bmatrix}$$

2 Marks GATE-EEE-2007( )

[A] Is zero when x and y are linearly independent
[B] Is positive when x and y are linearly independent
[C] Is non-zero for all non-zero x and y
[D] Is zero only when either x or y is zero

92) The linear operation L(x) is defined by the cross product L(x) = b x X where $b = \begin{bmatrix} 0 & 1 & 0 \end{bmatrix}^T$ and $x = \begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix}^T$ are three dimensional vectors. The 3 x 3 matrix M of this operation satisfies

$$L(x) = M \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}.$$

Then the eigen value of M are

2 Marks GATE-EEE-2007( )

[A] 0 + 1, -1
[B] 1, -1, 1
[C] i, -i, 1
[D] i, -i, 0

93) The characteristic equation of a (3 x3) matrix P is defined as $a(\lambda) = |\lambda I - P| = \lambda^3 + \lambda^2 + 2\lambda + 1 = 0$

If I denotes identity matrix then the inverse of matrix P will be

2 Marks GATE-EEE-2008( )

[A] $(P^2 + P + 2i)$
[B] $(P^2 + P + i)$
[C] $-(P^2 + P + i)$
[D] $-(P^2 + P + 2i)$

94) If the rank of a (5 x 6) matrix Q is 4 then which one of the following statements is correct?

2 Marks GATE-EEE-2008( )

[A] Q will have four linearly independent rows and four linearly independent columns
[B] Q will have for linearly independent rows and five linearly independent columns
[C] QQ^T will be invertible
[D] Q^TQ will be invertible

95) A is m x n full rank matrix with m > n and I is an identity matrix. Let matrix $A' = (A^TA)^{-1}A^T$. Then which one of the following statement is False?

2 Marks GATE-EEE-2008( )

[A] $AA'A = A$
[B] $(AA')^2 = AA'$
[C] $AA' = I$
[D] $AA'A = A$

96) Let P be a 2 X 2 real orthogonal matrix and $\vec{X}$ is a real vector $[x_1, x_2]^T$ with length $\| \vec{X} \| = (x_1^2 + x_2^2)^{1/2}$. Then which of one of the following statement is correct ?

2 Marks GATE-EEE-2008( )

[A] $\| P\vec{X} \| \le \| \vec{X} \|$ where at least one vector satisfies $\| P\vec{X} \| < \| \vec{X} \|$
[B] $\| P\vec{X} \| \le \| \vec{X} \|$ for all vectors $\vec{X}$
[C] $\| P\vec{X} \| \ge \| \vec{X} \|$ where at least one vector satisfies $\| P\vec{X} \| > \| \vec{X} \|$
[D] No relationship can be established between $\| \vec{X} \|$ and $\| P\vec{X} \|$

97) The equation $\begin{bmatrix} 2 & -2 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ has

1 Marks GATE-EEE-2013( )

[A] no solution

[B] only one solution $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

[C]non-zero unique solution

[D]multiple solutions

98) A polynomial $f(x) = a_4x^4 + a_3x^3 + a_2x^2 + a_1x - a_0$ with all coefficients positive has

1 Marks GATE-ECE/TCE-2013( )

[A] No real roots

[B] No negative real root

[C]Odd number of real roots

[D]At least one positive and one negative real root

99) Let A be an $m \times n$ matrix and B an $n \times m$ matrix It is given that determinant $(I_m + AB)$ = determinant $(I_n + BA)$, where I_k is the $k \times k$ identity matrix . Using the above property, the determinant of the matrix of the given below is

$$\begin{bmatrix} 2 & 1 & 1 & 1 \\ 1 & 2 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & 1 & 1 & 2 \end{bmatrix}$$

2 Marks GATE-ECE/TCE-2013( )

[A] 2

[B] 5

[C]8

[D]16

100) Which one of the following does NOT equal $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}$?

1 Marks GATE-CSE/IT-2013( )

[A] $\begin{vmatrix} 1 & x(x+1) & x+1 \\ 1 & y(y+1) & y+1 \\ 1 & z(z+1) & z+1 \end{vmatrix}$

[B] $\begin{vmatrix} 1 & x+1 & x^2+1 \\ 1 & y+1 & y^2+1 \\ 1 & z+1 & Z^2+1 \end{vmatrix}$

[C] $\begin{vmatrix} 0 & x-y & x^2-y^2 \\ 0 & y-z & y^2-z^2 \\ 1 & z & z^2 \end{vmatrix}$

[D] $\begin{vmatrix} 2 & x+y & x^2+y^2 \\ 2 & y+z & y^2+z^2 \\ 1 & z & z^2 \end{vmatrix}$

101) Let A be the 2 x 2 matrix with elements $a_{11} = a_{12} = a_{21} = +1$ and $a_{22} = -1$. Then $a_{22} = -1$. Then the eigen values of the matrix A^{19} are

1 Marks GATE-CSE/IT-2012( )

[A] 1024 and -1024

[B] 1024$\sqrt{2}$ and -1024$\sqrt{2}$

[C]4$\sqrt{2}$ and -4$\sqrt{2}$

[D]512$\sqrt{2}$ and -512$\sqrt{2}$

102) Given that $A = \begin{bmatrix} -5 & -3 \\ 2 & 0 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, the value of A^3 is

2 Marks GATE-EEE-2012,GATE-ECE/TCE-2012( )

[A] $15A + 12I$

[B] $19A + 30I$

[C] $17A + 15I$

[D] $17A + 21I$

103) The two vectors [1,1,1] and $[1, a, a^2]$, where $a = \left(-\frac{1}{2} + j\frac{\sqrt{3}}{2}\right)$, are

2 Marks GATE-EEE-2011( )

[A] Orthonormal

[B] Orthogonal

[C]Parallel

[D]collinear

104) The eigen values of a skew-symmetric matrix are

1 Marks GATE-ECE/TCE-2010( )

[A] Always zero

[B] Always pure imaginary

[C]Either zero or pure imaginary

[D]Always real

105) Consider the matrix as given below.

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & 7 \\ 0 & 0 & 3 \end{bmatrix}$$

Which one of the following provides the CORRECT values of eigenvalues of the matrix?

2 Marks GATE-CSE/IT-2011( )

[A] 1,4,3

[B] 3,7,3

[C]7,3,2

[D]1,2,3

106) An eigenvector of $P = \begin{pmatrix} 1 & 1 & 0 \\ 0 & 2 & 2 \\ 0 & 0 & 3 \end{pmatrix}$ is

2 Marks GATE-EEE-2010( )

[A] [-1 1 1] [B] [1 2 1]
[C] [1 -1 2] [D] [2 1 -1]

107) For the set of equations, $x_1 + 2x_2 + x_3 + 4x_4 = 2$ and $3x_1 + 6x_2 + 3x_3 + 12x_4 = 6$.
The following statement is true

2 Marks GATE-EEE-2010( )

[A] Only the trivial solution $x_1 = x_2 = 3x_3 = x_4 = 0$ exists [B] There are no solutions
[C] A unique non-trivial solution exists [D] Multiple non-trivial solutions exist

108) Consider the following matrix
A = $\begin{bmatrix} 2 & 3 \\ x & y \end{bmatrix}$
If the eigenvalues of A are 4 and 8, then

2 Marks GATE-CSE/IT-2010( )

[A] x = 4, y = 10 [B] x = 5, y = 8
[C] x = -3, y = 9 [D] x = -4, y = 10

109) The system of equations
x + y + z = 6
x + 4y + 6z = 20
$x + 4y + \lambda z = \mu$
has NO solution for values of λ and μ given by

2 Marks GATE-ECE/TCE-2011( )

[A] $\lambda = 6, \mu = 20$ [B] $\lambda = 6, \mu \neq 20$
[C] $\lambda \neq 6, \mu = 20$ [D] $\lambda \neq 6, \mu \neq 20$

110) The eigen values of the matrix $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ are

2 Marks GATE-ECE/TCE-1998( )

[A] 1 , 1 [B] -1 , -1
[C] j , -j [D] 1 , -1

111) The rank of the matrix $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$ is

1 Marks GATE-CSE/IT-2002( )

[A] 4 [B] 2
[C] 1 [D] 0

112) Consider the following statements:
S1: The sum of two singular n × n matrices may be non-singular
S2: The sum of two n × n non-singular matrices may be singular.
Which of the following statements is correct?

1 Marks GATE-CSE/IT-2001( )

[A] S1 and S2 are both true [B] S1 is true, S2 is false
[C] S1 is false, S2 is true [D] S1 and S2 are both false

113) Suppose the adjacency relation of vertices in a graph is represented in a table Adj (X,Y). Which of the following queries cannot be expressed by a relational algebra expression of constant length?

1 Marks GATE-CSE/IT-2001( )

[A] List of all vertices adjacent to a given vertex [B] List all vertices which have self loops
[C] List all vertices which belong to cycles of less than three vertices [D] List all vertices reachable from a given vertex

114) Among the following, the pair of vectors orthogonal to each other is

2 Marks GATE-ME-1995( )

[A] [3,4,7], [3,4,7] [B] [1,0,0], [1,1,0]
[C] [1,0,2], [0,5,0] [D] [1,1,1], [-1,-1,-1]

115) In the Gauss elimination method for solving a system of linear algebraic equations, triangularization leads to

Linear Algebra

1 Marks GATE-ME-1996( )

[A] diagonal matrix
[B] lower triangular matrix
[C]upper triangular matrix
[D]singular matrix

116) The eigen values of $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ are

2 Marks GATE-ME-1996( )

[A] 0,0,0
[B] 0,0,1
[C]0,0,3
[D]1,1,1

117) The eigenvalues of a symmetric matrix are all

1 Marks GATE-ME-2013( )

[A] complex with non-zero positive imaginary part.
[B]complex with non-zero negative imaginary part.
[C]real.
[D]pure imaginary.

118) Choose the CORRECT set of functions, which are linearly dependent.

1 Marks GATE-ME-2013( )

[A] sin x , $\sin^2 x$ and $\cos^2 x$
[B] cos x , sin x and tan x
[C]cos 2x , $\sin^2 x$ and $\cos^2 x$
[D]cos 2x , sin x and cos x

119) The eigen values of the matrix $\begin{bmatrix} 5 & 3 \\ 3 & -3 \end{bmatrix}$ are

2 Marks GATE-ME-1999( )

[A] 6
[B] 5
[C]-3
[D]-4

120) Consider the system of equations given below:

$$x+y=2$$
$$2x+2y=5$$

This system has

1 Marks GATE-ME-2001( )

[A] one solution
[B]no solution
[C]infinite solutions
[D]four solutions

121) The following set of equations has

$$3x+2y+z=4$$
$$x-y+z=2$$
$$-2x+2z=5$$

2 Marks GATE-ME-2002( )

[A] no solution
[B]a unique solution
[C]multiple solutions
[D]an inconsistency.

122) The rank of a 3 x 3 matrix C (=AB), found by multiplying a non-zero column matrix A of size 3 x 1 and a non-zero row matrix B of size 1x3 is

2 Marks GATE-ME-2001( )

[A] 0
[B] 1
[C]2
[D]3

123) For the matrix $\begin{bmatrix} 4 & 1 \\ 1 & 4 \end{bmatrix}$ the eigen values are

1 Marks GATE-ME-2003( )

[A] 3 and -3
[B]-3 and -5
[C]3 and 5
[D]5 and 0

124) The vector field. $\vec{F} = x\vec{i} - y\vec{j}$ (where $\vec{i}$ and $\vec{j}$ are unit vectors) is

2 Marks GATE-ME-2003( )

[A] divergence free, but not irrotational
[B] irrotational, but not divergence free
[C]divergence free and irrotational
[D]neither divergence free nor irrotational.

125) One of the eigen vectors of the matrix A = $\begin{bmatrix} 2 & 2 \\ 1 & 3 \end{bmatrix}$ is

2 Marks GATE-ME-2010( )

[A] $\begin{Bmatrix} 2 \\ -1 \end{Bmatrix}$
[B] $\begin{Bmatrix} 2 \\ 1 \end{Bmatrix}$
[C] $\begin{Bmatrix} 4 \\ 1 \end{Bmatrix}$
[D] $\begin{Bmatrix} 1 \\ -1 \end{Bmatrix}$

126) Eigenvalues of a real symmetric matrix are always

1 Marks GATE-ME-2011( )

[A] positive
[B] negative
[C]real
[D]complex

127) For the matrix $A = \begin{bmatrix} 5 & 3 \\ 1 & 3 \end{bmatrix}$, ONE of the normalized eigen vectors is given as

2 Marks GATE-ME-2012( )

[A] $\begin{bmatrix} \frac{1}{2} \\ \frac{\sqrt{3}}{2} \end{bmatrix}$
[B] $\begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{-1}{\sqrt{2}} \end{bmatrix}$
[C] $\begin{bmatrix} \frac{3}{\sqrt{10}} \\ \frac{-1}{\sqrt{10}} \end{bmatrix}$
[D] $\begin{bmatrix} \frac{1}{\sqrt{5}} \\ \frac{2}{\sqrt{5}} \end{bmatrix}$

128) x+2y +z =4
2x+y+2x = 5
x-y+z = 1
The system of algebraic equations given above has

2 Marks GATE-ME-2012( )

[A] a unique solution of x = 1, y = 1 and z = 1.
[B] only the two solutions of (x = 1, y = 1, z = 1) and (x = 2, y = 1, z = 0).
[C]infinite number of solutions.
[D]no feasible solution.

129) For a matrix $[M] = \begin{bmatrix} \frac{3}{5} & \frac{4}{5} \\ x & \frac{3}{5} \end{bmatrix}$, the transpose of the matrix is equal to the inverse of the matrix $[M]^T = [M]^{-1}$ The value of x is given by

1 Marks GATE-ME-2009( )

[A] $-\frac{4}{5}$
[B] $-\frac{3}{5}$
[C] $\frac{3}{5}$
[D] $\frac{4}{5}$

130) The sum of the eigen values of the given matrix
$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$

1 Marks GATE-ME-2004( )

[A] 5
[B] 7
[C] 9
[D] 18

131) For which value of r will the matrix given below become singular?
$\begin{bmatrix} 8 & x & 0 \\ 4 & 0 & 2 \\ 12 & 6 & 0 \end{bmatrix}$

2 Marks GATE-ME-2004( )

[A] 4
[B] 6
[C] 8
[D] 12

132) A is a 3 x 4 real matrix and Ax = b is an inconsistent system of equations. The highest possible rank of A is

1 Marks GATE-ME-2005( )

[A] 1
[B] 2
[C] 3
[D] 4

133) Which one of the following is an eigenvector of the matrix $\begin{bmatrix} 5 & 0 & 0 & 0 \\ 0 & 5 & 0 & 0 \\ 0 & 0 & 2 & 1 \\ 0 & 0 & 3 & 1 \end{bmatrix}$?

2 Marks GATE-ME-2005( )

[A] $\begin{bmatrix} 1 \\ -2 \\ 0 \\ 0 \end{bmatrix}$
[B] $\begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$
[C] $\begin{bmatrix} 1 \\ 0 \\ 0 \\ -2 \end{bmatrix}$
[D] $\begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$

134) Match the items in columns I and II.

Column I	Column II
P. Singular matrix	1. Determinant is not
Q. Non-square matrix	2. Determinant is always one
R. Real symmetric matrix	3, Determinant is zero
S. Orthogonal matrix	4. Eigen values are always real
	5, Eigen values are not defined

2 Marks GATE-ME-2006( )

[A]P-3, Q-1, R-4, S-2
[B]P-2, Q-3, R-4, S-1
[C]P-3, Q-2, R-5, S-4
[D]P-3, Q-4, R-2.S-1.

135) Multiplication of matrices E and F is G. Matrices.E and G are $E = \begin{bmatrix} cos\theta & -sin\theta & 0 \\ sin\theta & cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $G = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ What is the matrix F?

2 Marks GATE-ME-2006( )

[A] $\begin{bmatrix} cos\theta & -sin\theta & 0 \\ sin\theta & cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$
[B] $\begin{bmatrix} sin\theta & cos\theta & 0 \\ -cos\theta & sin\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$
[C] $\begin{bmatrix} cos\theta & sin\theta & 0 \\ -sin\theta & cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$
[D] $\begin{bmatrix} sin\theta & -cos\theta & 0 \\ cos\theta & sin\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$

136) The matrix $\begin{bmatrix} 1 & 2 & 4 \\ 3 & 0 & 6 \\ 1 & 1 & p \end{bmatrix}$ has one eigenvalue equal to 3. The sum of the other two eigenvalues is

1 Marks GATE-ME-2008( )

[A] p
[B] p - 1
[C] p - 2
[D] p -3

137) If a square matrix A is real and symmetric, then the Eigen values

1 Marks GATE-ME-2007( )

[A] are always real
[B] are always real and positive
[C]are always real and non-negative
[D]occur in complex conjugate pairs.

138) For what value of a, if any, will the following system of equations in x, y and. z have a solution ?

2x+3y= 4
x+Y+z=4
x+2y-z=a

2 Marks GATE-ME-2008( )

[A] Any real number
[B] 0
[C]1
[D]There is no such value.

139) The eigenvectors of the matrix $\begin{bmatrix} 1 & 2 \\ 0 & 2 \end{bmatrix}$ are written in the form $\begin{bmatrix} 1 \\ a \end{bmatrix}$ and $\begin{bmatrix} 1 \\ b \end{bmatrix}$. What is a+b ?

2 Marks GATE-ME-2008( )

[A]0
[B] 1/2
[C]1
[D]2

140) The area of a triangle formed by the tips of vectors $\bar{a}, \bar{b}$ and $\bar{c}$ is

2 Marks GATE-ME-2007( )

[A] $\frac{1}{2}\left|(\bar{a}-\bar{b}) \times (\bar{a}-\bar{c})\right|$
[B] $\frac{1}{2}\left|(\bar{a}-\bar{b}) \times (\bar{a}-\bar{c})\right|$
[C] $\frac{1}{2}\left|\bar{a} \times \bar{b} \times \bar{c}\right|$
[D] $\frac{1}{2}(\bar{a} \times \bar{b}).\bar{c}$

141) The number of linearly independent Eigen vectors of $\begin{bmatrix} 2 & 1 \\ 0 & 2 \end{bmatrix}$ is

2 Marks GATE-ME-2007( )

[A]0
[B] 1
[C]2
[D]infinite

Statement for Linked answer Q142 and Q143 is given below

142) $P = \begin{bmatrix} -10 \\ 1 \\ 3 \end{bmatrix}^T, Q = \begin{bmatrix} -2 \\ -5 \\ 9 \end{bmatrix}, R = \begin{bmatrix} 2 \\ -7 \\ 12 \end{bmatrix}$ are three vectors

An orthogonal set of vectors having a span that contains P, Q, R is

2 Marks GATE-EEE-2006,GATE-EEE-2006( )

[A] $\begin{bmatrix} -6 \\ -3 \\ -6 \end{bmatrix} \begin{bmatrix} 4 \\ -2 \\ 3 \end{bmatrix}$

[B] $\begin{bmatrix} -4 \\ 2 \\ 4 \end{bmatrix} \begin{bmatrix} 5 \\ 7 \\ -11 \end{bmatrix} \begin{bmatrix} 8 \\ 2 \\ -3 \end{bmatrix}$

[C] $\begin{bmatrix} 6 \\ 7 \\ -1 \end{bmatrix} \begin{bmatrix} -3 \\ 2 \\ -2 \end{bmatrix} \begin{bmatrix} 3 \\ 9 \\ -4 \end{bmatrix}$

[D] $\begin{bmatrix} 4 \\ 3 \\ 11 \end{bmatrix} \begin{bmatrix} 1 \\ 31 \\ 3 \end{bmatrix} \begin{bmatrix} 5 \\ 3 \\ 4 \end{bmatrix}$

143) The following vector is linearly dependent upon the solution to the previous problem

2 Marks GATE-EEE-2006( )

[A] $\begin{bmatrix} 8 \\ 9 \\ 3 \end{bmatrix}$

[B] $\begin{bmatrix} -2 \\ -17 \\ 30 \end{bmatrix}$

[C] $\begin{bmatrix} 4 \\ 4 \\ 5 \end{bmatrix}$

[D] $\begin{bmatrix} 13 \\ 2 \\ -3 \end{bmatrix}$

Statement for Linked answer Q144 and Q145 is given below

144) Cayley- Hamilton Theorem states that a square matrix satisfies its own characteristic equation. Consider matrix

$A = \begin{bmatrix} -3 & 2 \\ -1 & 0 \end{bmatrix}$

A satisfies the relation

2 Marks GATE-EEE-2007,GATE-EEE-2007( )

[A] $A + 3I + 2A^{-1} = 0$

[B] A2 + 2A + 2I = 0

[C] (A+I) (A+2I)

[D] exp (A) = 0

145) A^9 equals

2 Marks GATE-EEE-2007( )

[A] 511 A + 510 I

[B] 309 A + 104 I

[C] 154 A + 155 I

[D] exp (9A)

Linear Algebra

Key Paper

1.	A	2.	B	3.	C	4.	C	5.	A
6.	A	7.	A	8.	D	9.	C	10.	C
11.	A	12.	B	13.	A	14.	D	15.	D
16.	B	17.	C	18.	C	19.	C	20.	B
21.	C	22.	A	23.	A	24.	B	25.	D
26.	C	27.	A	28.	B	29.	B	30.	D
31.	A	32.	A	33.	B	34.	D	35.	A
36.	B	37.	B	38.	C	39.	B	40.	A
41.	A	42.	D	43.	C	44.	B	45.	A
46.	D	47.	A	48.	A	49.	A	50.	A
51.	A	52.	C	53.	A	54.	C	55.	B
56.	B	57.	A	58.	D	59.	B	60.	A
61.	A	62.	B	63.	A	64.	A	65.	A
66.	B	67.	A	68.	A	69.	C	70.	A
71.	B	72.	B	73.	B	74.	A	75.	C
76.	A	77.	C	78.	C	79.	A	80.	C
81.	C	82.	C	83.	B	84.	D	85.	D
86.	A	87.	D	88.	B	89.	B	90.	C
91.	D	92.	D	93.	D	94.	A	95.	A
96.	B	97.	D	98.	D	99.	B	100.	A
101.	D	102.	B	103.	B	104.	C	105.	A
106.	B	107.	D	108.	D	109.	B	110.	D
111.	C	112.	C	113.	C	114.	C	115.	C
116.	C	117.	C	118.	C	119.	A	120.	B
121.	B	122.	A	123.	C	124.	C	125.	A
126.	C	127.	B	128.	C	129.	A	130.	B
131.	A	132.	C	133.	A	134.	A	135.	C
136.	C	137.	A	138.	D	139.	B	140.	B
141.	B	142.	D	143.	D	144.	A	145.	A

1) The function f(t) has the Fourier Transform g(ω). The Fourier Transform $ff(t)g(t) = \left(\int_{-\infty}^{\infty} g(t)e^{-j\omega t}dt\right)$ is

2 Marks GATE-ECE/TCE-1997( )

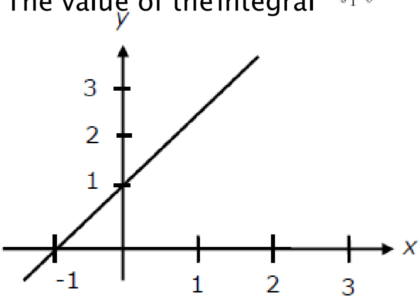
[A] $\frac{1}{2\Pi}f(\omega)$
[B] $\frac{1}{2\Pi}f(-\omega)$
[C] $2\Pi f(-\omega)$
[D] None of the above

2) Which of the following improper integrals is (are) convergent?

2 Marks GATE-ECE/TCE-1993( )

[A] $\int_0^1 \frac{sinx}{1-cosx}dx$
[B] $\int_0^{\infty} \frac{cosx}{1+x}dx$
[C] $\int_0^{\infty} \frac{x}{1+x^2}dx$
[D] $\int_0^1 \frac{1-cosx}{1+x^{\frac{5}{2}}}dx$

3) The following plot shows a function y which varies linearly with x . The value of the integral $I = \int_1^2 y\ dx$ is

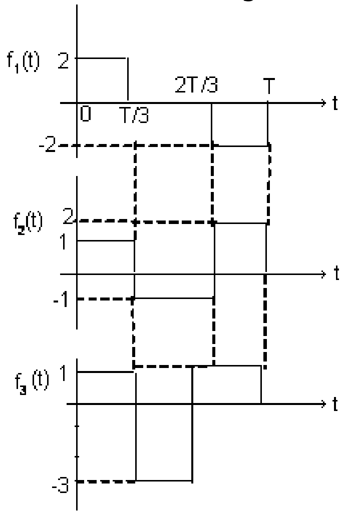


2 Marks GATE-ECE/TCE-2007( )

[A] 1.0
[B] 2.5
[C] 4.0
[D] 5.0

4) Three functions $f_1(t)$, $f_2(t)$ and $f_3(t)$ which are zero outside the interval [0, T] are shown in the figure.

Which of the following statements is correct ?



2 Marks GATE-ECE/TCE-2007( )

[A] $f_1(t)$ and $f_2(t)$ are orthogonal
[B] $f_1(t)$ and $f_3(t)$ are orthogonal
[C] $f_2(t)$ and $f_3(t)$ are orthogonal
[D] $f_1(t)$ and $f_2(t)$ are orthogonal

5) If $X = \sqrt{-1}$, then the value of X^X is

1 Marks GATE-EEE-2012,GATE-ECE/TCE-2012( )

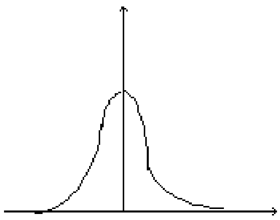
[A] $e^{-\frac{\pi}{2}}$
[B] $e^{\frac{\pi}{2}}$
[C] x
[D] 1

6) The value of the integral $I = \frac{1}{\sqrt{2\pi}}\int_0^{\infty} exp\left(-\frac{X^2}{8}\right)dX$

2 Marks GATE-ECE/TCE-2005( )

[A] 1
[B] π
[C] 2
[D] 2π

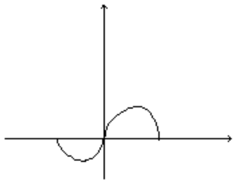
7) The derivative of the symmetric function drawn in given figure will look like



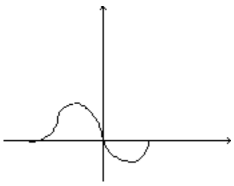
2 Marks GATE-ECE/TCE-2005( )

[A]

[B]



[C]



[D]

2 Marks GATE-ECE/TCE-2006( )

$\nabla^2 P + \nabla(\nabla \times P)$

$\nabla(\nabla . P) - \nabla^2 P$

2 Marks GATE-ECE/TCE-2006( )

8) $\nabla \times \nabla \times P$, where P is a vector is equal to

$\oint \nabla \times \nabla \times P.dl$

$\int\int\int \nabla . P \ dv$

[A] $P \times \nabla \times P - \nabla^2 P$

$\frac{e^X}{1+e^X}$

[B]

[C] $\nabla^2 P + (\nabla \times P)$

[D]

9) $\int\int \nabla \times P \ ds$ where P is a vector, is equal to

2 Marks GATE-ECE/TCE-2006( )

[A] $\oint P.dl$

[B]

[C] $\oint \nabla \times P.dl$

[D]

10)

As x increased from − ∞ to ∞, the function f (x) =

[A] Monotonically increases

[B] Monotonically decreases

[C] Increases to a maximum value and then decreases

[D] Decreases to a minimum value and then increases

11) For |x| <<1, coth (x) can be approximated as

1 Marks GATE-ECE/TCE-2007( )

[A] x

[B] x^2

[C] 1 /x

[D] $1/x^2$

12) Which one of the following is strictly bounded?

1 Marks GATE-ECE/TCE-2007( )

[A] $1/x^2$

[B] e^x

[C] x^2

[D] e^{-x2}

13) For the function e^{-x} the linear approximation around x = 2 is

1 Marks GATE-ECE/TCE-2007( )

[A] $(3-x)e^{-2}$

[B] $1-x$

[C] $[3+2\sqrt{2}-(1+\sqrt{2})x]e^{-2}$

[D] e^{-2}

14) Consider the function $f(x) = x^2 - x - 2f$(. The maximum value of f(x) in the closed interval [−4, 4] is

2 Marks GATE-ECE/TCE-2007( )

[A] 18

[B] 10

[C] −2.25

[D] Indeterminate

15) For real values of x, the minimum value of the function f(x)= exp (x) + exp (−x) is

2 Marks GATE-ECE/TCE-2008( )

[A] 2
[B] 1
[C] 0.5
[D] 0

16) Which of the following functions would have only odd powers of x in its Taylor series expansion about the point x = 0?

2 Marks GATE-ECE/TCE-2008( )

[A] $sin(x^3)$
[B] $sin(x^2)$
[C] $cos(x^3)$
[D] $cos(x^2)$

17) In the Taylor series expansion of exp(x) + sin (x) about the point x = π, the coefficient of $(x - \Pi)^2$ is

2 Marks GATE-ECE/TCE-2008( )

[A] exp (π)
[B] 0.5 exp (π)
[C] exp (π) + 1
[D] exp (π) -1

18) The value of the integral of the function $g(x, y) = 4x^3 + 10y^4$ along the straight line segment from the point (0,0) to the point (1,2) in the x-y plane is

2 Marks GATE-ECE/TCE-2008( )

[A] 33
[B] 35
[C] 40
[D] 56

19) Consider points P and Q in the x-y plane, with P = (1, 0) and Q = (0,1). The line integral $2\int_P^Q (xdx + ydy)$ along the semicircle with the line segment PQ as its diameter

2 Marks GATE-ECE/TCE-2008( )

[A] is -1
[B] is 0
[C] is 1
[D] depends on the direction (clockwise or anticlockwise) of the semicircle

20) The Taylor series expansion of $\frac{sinX}{x - \pi}$ at $x = \Pi$ given by

2 Marks GATE-ECE/TCE-2009( )

[A] $1 + \frac{(X-\pi)^2}{3!} + ...$
[B] $-1 - \frac{(X-\pi)^2}{3!} + ...$
[C] $1 - \frac{(X-\pi)^2}{3!} + ...$
[D] $-1 + \frac{(X-\pi)^2}{3!} + ...$

21) The maximum value of θ until which the approximation $\sin\theta \approx \theta$ holds to within 10% error is

1 Marks GATE-ECE/TCE-2013( )

[A] 10^0
[B] 18^0
[C] 50^0
[D] 90^0

22) The maximum value of $f(x) = x^3 - 9x^2 + 24x + 5$ in the interval [1 6] is

2 Marks GATE-EEE-2012,GATE-ECE/TCE-2012( )

[A] 21
[B] 25
[C] 41
[D] 46

23) If $e^y = X^{\frac{1}{x}}$, then y has a

2 Marks GATE-ECE/TCE-2010( )

[A] Maximum at X = e
[B] Minimum at X = e
[C] Maximum at $X = e^{-1}$
[D] Minimum at $X = e^{-1}$

Calculus

Key Paper

1.	**C**	**2.**	**A**	**3.**	**B**	**4.**	**C**	**5.**	**A**
6.	**A**	**7.**	**C**	**8.**	**D**	**9.**	**A**	**10.**	**A**
11.	**C**	**12.**	**D**	**13.**	**A**	**14.**	**A**	**15.**	**A**
16.	**A**	**17.**	**B**	**18.**	**A**	**19.**	**B**	**20.**	**B**
21.	**B**	**22.**	**C**	**23.**	**A**				

Differential Equations

1) The formula used to compute an approximation for the second derivative of a function f at a point x_0 is.

1 Marks GATE-CSE/IT-1996( )

[A] $\frac{f(x_0+h)+f(x_0-h)}{2}$ [B] $\frac{f(x_0+h)-f(x_0-h)}{2h}$

[C] $\frac{f(x_0+h)+2f(x_0)+f(x_0-h)}{h^2}$ [D] $\frac{f(x_0+h)-2f(x_0)+f(x_0-h)}{h^2}$

2) Thesolutionofdifferentialequation y_'' +3y_' +2y=0isoftheform

2 Marks GATE-CSE/IT-1995( )

[A] $C_1e^{x}+C_2e^{2x}$ [B] $C_1e^{-x}+C_2e^{3x}$

[C] $C_1e^{-x}+C_2e^{-2x}$ [D] $C_1e^{-2x}+C_2 2^{-x}$

3) Backward Euler method for solving the differential equation $\frac{dy}{dx}=f(x,y)$ is specified by, (choose one of the following).

1 Marks GATE-CSE/IT-1994( )

[A] $y_{n+1}=y_n+hf(x_n,y_n)$ [B] $y_{n+1}=y_n+hf(x_{n+1},y_{n+1})$

[C] $y_{n+1}=y_{n-1}+2hf(x_n,y_n)$ [D] $y_{n+1}=(1+h)f(x_{n+1},y_{n+1})$

4) The differential equation $\frac{d^2y}{dx^2}+\frac{dy}{dx}+\sin y=0$ is

1 Marks GATE-CSE/IT-1993( )

[A] linear [B] non-linear

[C] homogeneous [D] of degree two

5) The differential equation $\frac{d^2y}{dx^2}+\sin y=0$

2 Marks GATE-ECE/TCE-1993( )

[A] linear [B] non-linear

[C] homogeneous [D] of degree two

6) With initial condition x(1)=0.5 the solution of the differential equation $t\frac{dX}{Dt}+X=t$ is

1 Marks GATE-EEE-2012,GATE-ECE/TCE-2012( )

[A] $X=t-\frac{1}{2}$ [B] $X=t^2-\frac{1}{2}$

[C] $X=\frac{t^2}{2}$ [D] $X=\frac{t}{2}$

7) With K as a constant, the possible solution for the first order differential equation $\frac{dy}{dx}=e^{-3x}$

1 Marks GATE-EEE-2011( )

[A] $-\frac{1}{3}e^{-3x}+K$ [B] $-\frac{1}{3}e^{3x}+K$

[C] $-\frac{1}{3}e^{-3x}+K$ [D] $-3e^{-x}+K$

8) The order and degree of the differential equation $\frac{d^3y}{dx^3}+4\sqrt{\left(\frac{dy}{dx}\right)^3}+y^2=0$ are respectively

1 Marks GATE-CE-2010( )

[A] 3 and 2 [B] 2 and 3

[C] 3 and 3 [D] 3 and 1

9) The solution to the ordinary differential equation $\frac{d^2y}{dx^2}+\frac{dy}{dx}-6y=0$

2 Marks GATE-CE-2010( )

[A] $y=c_1e^{3x}+c_2e^{-2x}$ [B] $y=c_1e^{3x}+c_2e^{2x}$

[C] $y=c_1e^{-3x}+c_2e^{2x}$ [D] $y=c_1e^{-3x}+c_2e^{-2x}$

10) The partial differential equation that can be formed from z=ax + by + ab has the from (with $p=\frac{\partial z}{\partial x}$ and $q=\frac{\partial z}{\partial y}$)

2 Marks GATE-CE-2010( )

[A] z = px + qy [B] z = px + pq

[C] z = px + qy + pq [D] z = qy + pq

11) Given a function $f(x,y)=4x^2+6y^2+-8x-4y+8$

The optimal value of f(x, y)

Differential Equations

2 Marks GATE-CE-2010( )

[A] Is a minimum equal to 10/3
[B] Is a maximum equal to 10/3
[C] Is a minimum equal to 8/3
[D] Is a maximum equal to 8/3

12) The solution of the ordinary differential equation $\frac{dy}{dx} + 2y = 0$ for the boundary condition, y = 5 at x=1

2 Marks GATE-CE-2012( )

[A] $y = e^{-2x}$
[B] $y = 2e^{-2x}$
[C] $y = 10.95e^{-2x}$
[D] $y = 36.95e^{-2x}$

13) For an analytic function, f(x+iy)=u(x,y)+iv(x,y), u is given by u=$3x^2$ -$3y^2$. The expression for v, considering K to be a constant is

2 Marks GATE-CE-2011( )

[A] $3y^2 - 3x^2 + K$
[B] 6x– 6y + K
[C] 6y – 6x + K
[D] 6xy + K

14) The solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = x$, with the condition that y = 1 at x = 1, is

2 Marks GATE-CE-2011( )

[A] $y = \frac{2}{3x^2} + \frac{x}{3}$
[B] $y = \frac{x}{2} + \frac{1}{2x}$
[C] $y = \frac{2}{3} + \frac{x}{3}$
[D] $y = \frac{2}{3x} + \frac{x^2}{3}$

15) The differential equation $\frac{dy}{dx} = 0.25y^2$ is to be solved using the backward (implicit) Euler's method with boundary condition y=1 at x=0 and with a step size of 1. What would be the value of y at x=1

1 Marks GATE-CE-2006( )

[A] 1.33
[B] 1.67
[C] 2.00
[D] 2.33

16) The general solution $\frac{d^2y}{dx^2} - y = 0$ is

1 Marks GATE-CE-2008( )

[A] $y = p\ cos\ x + \ Q\ sin\ x$
[B] $y = p\ cos\ x$
[C] $y = \ P\ sin\ x$
[D] $y = \ P\ sin^2\ x$

17) Solution of the differential equation $3y\frac{dy}{dx} + 2x = 0$ represents a family of

2 Marks GATE-CE-2009( )

[A] ellipses
[B] circles
[C] parabolas
[D] hyperbolas

18) The solution of the differential equation, $x^2\frac{dy}{dx} + 2xy - x + 1$, given that at x = 1 , y = 0 is

2 Marks GATE-CE-2006( )

[A] $\frac{1}{2} - \frac{1}{x} + \frac{1}{2x^2}$
[B] $\frac{1}{2} - \frac{1}{x} - \frac{1}{2x^2}$
[C] $\frac{1}{2} + \frac{1}{x} + \frac{1}{2x^2}$
[D] $-\frac{1}{2} + \frac{1}{x} + \frac{1}{2x^2}$

19) The equation $k_x\frac{\partial^2 h}{\partial x^2} + k_z\frac{\partial^2 h}{\partial z^2} = 0$ can be transformed to $\frac{\partial^2 h}{\partial x_1^2} + \frac{\partial^2 h}{\partial z^2} = 0$ by substiting

2 Marks GATE-CE-2008( )

[A] $x_1 = x\frac{k_z}{k_x}$
[B] $x_1 = x\frac{k_x}{k_z}$
[C] $x_1 = x\sqrt{\frac{k_x}{k_z}}$
[D] $x_1 = x\sqrt{\frac{k_z}{k_x}}$

20) Solution of $\frac{dy}{dx} = -\frac{x}{y}$ at x=1 and $x = \sqrt{3}$ is

2 Marks GATE-CE-2008( )

[A] $x.y^2 = 2$
[B] $x + y^2 = 4$
[C] $x^2.y^2 = -2$
[D] $x^2 + y^2 = 4$

21) The solution of $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 17y = 0,\ y(0) = 1$, $\frac{dy}{dx}\left(\frac{p}{4}\right) = 0$ in the range $0 < x < \frac{\pi}{4}$ is given by

2 Marks GATE-CE-2005( )

[A] $e^{-x}\left(cos4x + \frac{1}{4}sin4x\right)$
[B] $e^{x}\left(cos4x - \frac{1}{4}sin4x\right)$
[C] $e^{-4x}\left(cosx - \frac{1}{4}sinx\right)$
[D] $e^{-4x}\left(cos4x - \frac{1}{4}sin4x\right)$

22) The degree of the differential equation $\frac{d^2x}{dt^2} + 2x^3 = 0$ is

1 Marks GATE-CE-2007( )

[A] 0
[B] 1
[C] 2
[D] 3

23) The solution for the differential equation $\frac{dy}{dx} = x^2 y$ with condition that y = 1 at x=0 is

1 Marks GATE-CE-2007( )

[A] $y = e^{\frac{1}{2x}}$

[B] $ln(y) = \frac{x^3}{3} + 4$

[C] $ln(y) = \frac{x^2}{2}$

[D] $y = e^{\frac{x^3}{3}}$

24) A body originally at 60^0C cools down to 40^0C in 15minutes when kept in air at a temperature of 25^0C. What will be the temperature of the body at the end of 30minutes?

2 Marks GATE-CE-2007( )

[A] $35.2^0\ C$

[B] $31.5^0\ C$

[C] $28.7^0\ C$

[D] $15^0\ C$

25) For the differentia l equation, f(x,y) $\frac{dy}{dx}$ + g(x,y) = 0 to be exact,

2 Marks GATE-CE-1997( )

[A] $\frac{\partial f}{\partial y} = \frac{\partial g}{\partial x}$

[B] $\frac{\partial f}{\partial x} = \frac{\partial g}{\partial y}$

[C] f = g

[D] $\frac{\partial^2 f}{\partial x^2} = \frac{\partial^2 g}{\partial y^2}$

26) The differential equa tion $\frac{dy}{dx}$ + Py = Q, is a linear equation of first order only if

2 Marks GATE-CE-1997( )

[A] P is a constant but Q is a function of y

[B] P and Q are functions of y or constants

[C] P is a function of y but Q is a constant

[D] P and Q are functions of x or constants

27) Biotransformation of an organic compound having concentration (x) can be modeled using an ordinary differential equation $\frac{dx}{dt} + kx^2 = 0$, where k is the reaction rate constant. If x = a at t = 0, the solution of the equation is

2 Marks GATE-CE-2004( )

[A] $x = ae^{-kt}$

[B] $\frac{1}{x} = \frac{1}{a} + kt$

[C] $x = a(1 - e^{-kt})$

[D] $x = a + kt$

28) The number of boundary conditions required to solve the differential equations $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$ is

1 Marks GATE-CE-2001( )

[A] 2

[B] 0

[C] 4

[D] 1

29) The solution for the following differential equation with boundary conditions y(0) = 2 and y'(1) = −3 is $\frac{d^2y}{dx^2} = 3x - 2$

2 Marks GATE-CE-2001( )

[A] $y = \frac{x^3}{3} - \frac{x^2}{2} + 3x - 6$

[B] $y = 3x^3 - \frac{x^2}{2} - 5x + 2$

[C] $y = \frac{x^3}{2} - x^2 - \frac{5x}{2} + 2$

[D] $y = x^3 - \frac{x^2}{2} + 5x + \frac{3}{2}$

30) Number of terms in the expansion of general determinant of order n is

2 Marks GATE-CE-1999( )

[A] n^2

[B] $n!$

[C] n

[D] $(n+1)^2$

31) If c is a constant , solution of the equation $\frac{dy}{dx} = 1 + y^2$ *is*

2 Marks GATE-CE-1999( )

[A] y=sin(x+c)

[B] y=cos(x+c)

[C] y=tan(x+c)

[D] $y = e^x + c$

32) The equation $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 1 & -1 \\ y & x^2 & x \end{bmatrix}$=0 represents a parabola passing through the points

2 Marks GATE-CE-1999( )

[A] (0, 1), (0, 2), (0, −1)

[B] (0, 0), (−1, 1),(1, 2)

[C] (1, 1), (0, 0), (2, 2)

[D] (1, 2), (2i 1), (0, 0)

33) Consider the differential equation $\ddot{y} + 2\dot{y} + y = 0$ with boundary conditions y(0) = 1 , y(1) = 0. The value of y(2) is

2 Marks GATE-EIN/IN-2011( )

[A] -1 [B] $-e^{-1}$

[C] $-e^{-2}$ [D] $-e^{2}$

34) Consider the difference equation $y[n] - \frac{1}{3}y[n-1] = x[n]$ and suppose that $x[n] = \left(\frac{1}{2}\right)^n u[n]$. Assuming the condition of initial of rest , the solution for y[n] , $n \geq 0$ is

2 Marks GATE-EIN/IN-2011( )

[A] $3\left(\frac{1}{3}\right)^n - 2\left(\frac{1}{2}\right)^n$ [B] $-2\left(\frac{1}{3}\right)^n + 3\left(\frac{1}{2}\right)^n$

[C] $\frac{2}{3}\left(\frac{1}{3}\right)^n + \frac{1}{3}\left(\frac{1}{2}\right)^n$ [D] $\frac{1}{3}\left(\frac{1}{3}\right)^n + \frac{2}{3}\left(\frac{1}{2}\right)^n$

35) The type of the partial differential equation $\frac{\partial f}{\partial t} = \frac{\partial^2 f}{\partial x^2}$ is

1 Marks GATE-EIN/IN-2013( )

[A] parabolic [B] Elliptic

[C] Hyperbolic [D] Nonlinear

36) While numerically solving the differential equation $\frac{dy}{dx} + 2xy^2 = 0$, y(0) = 1, using Euler's predictorcorrector (improved Euler-Cauchy) method with a step size of 0.2, the value of y after the first step is

2 Marks GATE-EIN/IN-2013( )

[A] 1.00 [B] 1.03

[C] 0.97 [D] 0.96

37) The maximum value of $f(x) = x^3 - 9x^2 + 24x + 5$ in the interval [1,6] is:

2 Marks GATE-EIN/IN-2012( )

[A] 21 [B] 25

[C] 41 [D] 46

38) Consider the Differential equation

$\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = \delta(t)$ with $y(t)|_{t=0} = -2$ and $\frac{dy}{dt}|_{t=0^-} = 0$

The numerical value of $\frac{dy}{dt}|_{t=0^+} = 0$ is :

2 Marks GATE-EIN/IN-2012( )

[A] -2 [B] -1

[C] 0 [D] 1

39) Given $y = x^2 + 2x + 10$, the value of $\frac{dy}{dx}|_{x=1}$ is equal to

1 Marks GATE-EIN/IN-2008( )

[A] 0 [B] 4

[C] 12 [D] 13

40) Consider the differential equation $\frac{dy}{dx} = 1 + y^2$ Which one of the following can be a particular solution of this differential equation?

2 Marks GATE-EIN/IN-2008( )

[A] y = tan(x+3) [B] y = tanx + 3

[C] x=tan(y+3) [D] x = tany+3

41) Consider the function y = x^2 – 6x +9 The maximum value of y obtained when x varies over the interval 2 to 5 is

2 Marks GATE-EIN/IN-2008( )

[A] 1 [B] 3

[C] 4 [D] 9

42) Consider differential equation $\frac{dy}{dx} + y = e^x$ with y (0) = 1 . The value of y(1) is

2 Marks GATE-EIN/IN-2010( )

[A] $e + e^{-1}$ [B] $\frac{1}{2}(e - e^{-1})$

[C] $\frac{1}{2}(e + e^{-1})$ [D] $2(e - e^{-1})$

43) The differential equation $\frac{dx}{dt} = \frac{4-x}{\tau}$ with x(0)=0, and the constant τ>0 , is to be numerically integrated using the forward Euler method with a constant integration time step T. The maximum value of T such that the numerical solution of x converges is

Differential Equations

2 Marks GATE-EIN/IN-2009( )

[A] $\pi/4$

[B] $\pi/2$

[C] π

[D] 2π

44) The general solution of the differential equation $(D^2 - 4D + 4)y = 0$, is of the form (given D=d/dx) and C_1 and C_2 are constants

2 Marks GATE-EIN/IN-2005( )

[A] C_1e^{2x}

[B] $C_1e^{2x} + C_2e^{-2x}$

[C] $C_1e^{2x} + C_2xe^{-2x}$

[D] $C_1e^{2x} + C_2xe^{2x}$

45) The following differential equation has $3\left(\frac{d^2y}{dt^2}\right) + 4\left(\frac{dy}{dt}\right)^3 + y^2 + 2 = x$

2 Marks GATE-ECE/TCE-2005( )

[A] degree = 2, order = 1

[B] degree = 1, order = 2

[C] degree = 4, order = 3

[D] degree = 2, order = 3

46) A solution of the following differential equation is given by $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$

2 Marks GATE-ECE/TCE-2005( )

[A] $y = e^{2x} + e^{-3x}$

[B] $y = e^{2x} + e^{3x}$

[C] $y = e^{-2x} + e^{3x}$

[D] $y = e^{-2x} + e^{-3x}$

47) A solution for the differential equation $\dot{x}(t) + 2x(t) = \delta(t)$ with initial condition x(0−)= 0 is

2 Marks GATE-ECE/TCE-2006( )

[A] $e^{-2t}u(t)$

[B] $e^{2t}u(t)$

[C] $e^{-t}u(t)$

[D] $e^{t}u(t)$

48) For the differential equation $\frac{d^2y}{dX^2} + k^2y = 0$ the boundary conditions are

(i) y = 0 for x = 0 and (ii) y = 0 for x = a

The form of non-zero solutions of y (where m varies over all integers) are

2 Marks GATE-ECE/TCE-2006( )

[A] $y = \sum_m A_m sin\frac{m\pi X}{a}$

[B] $y = \sum_m A_m cos\frac{m\pi X}{a}$

[C] $y = \sum_m A_m X^{\frac{m\pi}{a}}$

[D] $y = \sum_m A_m e^{\frac{m\pi}{a}}$

49) The solution of the differential equation $k^2\frac{d^2y}{dX^2} = y - y_2$ under the boundary conditions

(i) y = y_1 at x = 0 and

(ii) y = y_2 at x = ∞, where k, y_1 and y_2 are constant is

2 Marks GATE-ECE/TCE-2007( )

[A] $y = (y_1 - y_2)exp(-x/k^2) + y_2$

[B] $y = (y_2 - y_1)exp(-x/k) + y_1$

[C] $y = (y_1 - y_2)sin\,h(x/k) + y_1$

[D] $y = (y_1 - y_2)exp(-x/k) + y_2$

50) Which of the following is a solution to the differential equation $\frac{dx(t)}{dt} + 3x(t) = 0$?

2 Marks GATE-ECE/TCE-2008( )

[A] $x(t) = 3e^{-t}$

[B] $x(t) = 2e^{-3t}$

[C] $x(t) = (-3/2)t^2$

[D] $x(t) = 3t^2$

51) The order of the differential equation $\frac{d^2y}{dt^2} + \left(\frac{dy}{dt}\right)^3 + y^4 = e^{-t}$ is

1 Marks GATE-ECE/TCE-2009( )

[A] 1

[B] 2

[C] 3

[D] 4

52) Match each differential equation in Group I to its family of solution curves from Group II

Group I	Group II
A . $\frac{dy}{dx} = \frac{y}{x}$	1 . Circles
B . $\frac{dy}{dx} = \frac{y}{x}$	2 . Straight lines
C . $\frac{dy}{dx} = \frac{x}{y}$	3 . Hyperbolas
D . $\frac{dy}{dx} = \frac{x}{y}$	

2 Marks GATE-ECE/TCE-2009( )

[A] A B C D
2 3 3 1

[B] A B C D
1 3 2 1

[C] A B C D
2 1 3 3

[D] A B C D
3 2 1 2

53) The solution of the first order differential equation $x'(t) = -3x(t)$, x (0) = x_0 is

2 Marks GATE-EEE-2005( )

[A] $x(t) = x_0 e^{-3t}$

[B] $x(t) = x_0 e^{-3}$

[C] $x(t) = x_0 e^{-1/3}$

[D] $x(t) = x_0 e^{-1}$

54) Equation $e^x - 1 = 0$ is required to be solved using Newton's method with a initial guess $x_0 = -1$. Then, after one step of Newton's method, estimate x_1 of the solution will be given by

2 Marks GATE-EEE-2008( )

[A] 0.71828

[B] 0.36784

[C] 0.20587

[D] 0.00000

55) A system is described by the differential equation $\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y(t) = x(t)$. Let x(t) be a rectangular pulse given by

$$x(t) = \begin{cases} 1 & 0 < t < 2 \\ 0 & otherwise \end{cases}$$

Assuming that y(0) = 0 and $\frac{dy}{dt} = 0$ at t = 0 , the Laplace transform of y(t) is

2 Marks GATE-ECE/TCE-2013( )

[A] $\frac{e^{-2s}}{s(s+2)(s+3)}$

[B] $\frac{1 - e^{-2s}}{s(s+2)(s+3)}$

[C] $\frac{e^{-2s}}{(s+2)(s+3)}$

[D] $\frac{1 - e^{-2s}}{(s+2)(s+3)}$

56) A system described by a linear, constant coefficient, ordinary, first order differential equation has an exact solution given by y(t) for t>0, when the forcing function is x(t) and the initial condition is y(0). If one wishes to modify the system so that the solution becomes −2y(t) for t>0, we need to

2 Marks GATE-ECE/TCE-2013( )

[A] change the initial condition to -y(0) and the forcing function to 2x(t)

[B] change the initial condition to 2y (0) and the forcing function to −x (t)

[C] Change the initial condition to $j\sqrt{2y(0)}$ and the forcing function to $j\sqrt{2x(t)}$

[D] change the initial condition to 2y (0) and the forcing function to −2x (t)

57) Consider the differential equation

$\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = \delta(t)$, with $y(t)|_{t=0} = -2$ and $\frac{dy}{dt}|_{t=0} = 0$

The numerical value of $\frac{dy}{dt}|_{t=0}$ is

2 Marks GATE-EEE-2012,GATE-ECE/TCE-2012( )

[A] −2

[B] −1

[C] 0

[D] 1

58) A function n(x) satisfied the differential equation $\frac{d^2n(x)}{dx^2} - \frac{n(x)}{L^2} = 0$ where L is a constant . The boundary conditions are : n(0) = K and $n(\infty) = 0$. The solution to this equation is

1 Marks GATE-ECE/TCE-2010( )

[A] n (x) = K exp(x/L)
[B] $n(x) = K\ exp(-x/\sqrt{L})$
[C] $n(x) = K^2\ exp(-x/L)$
[D] n(x) = K exp(−x/L)

59) Consider differential equation $\frac{dy(x)}{dx} - y(x) = x$ with the initial condition y(0)=0 . Using Euler's first order method with a step of 0.1 , the value of y(0.3) is

2 Marks GATE-ECE/TCE-2010( )

[A] 0.01
[B] 0.031
[C] 0.0631
[D] 0.1

60) For the differential equation $\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 8x = 0$ with initial conditions X(0)=1 and $\frac{dx}{dt}|_{t=0}$, the solution is

2 Marks GATE-EEE-2010( )

[A] $x(t) = 2e^{-6t} - e^{-2t}$
[B] $x(t) = 2e^{-2t} - e^{-4t}$
[C] $x(t) = -e^{-6t} + 2e^{-4t}$
[D] $x(t) = -e^{-2t} + 2e^{-4t}$

61) The solution of the differential equation $\frac{dy}{dx} = ky,\ y(0) = c$ is

1 Marks GATE-ECE/TCE-2011( )

[A] $x = ce^{-ky}$
[B] $x = ke^{cy}$
[C] $y = ce^{kx}$
[D] $y = ce^{-kx}$

62) The value of ξ in the mean value theorem of $f(b) - f(a) = (b-a)f'(\xi)\ for\ f(x) = Ax^2 + Bx + c$ in (a,b) is

2 Marks GATE-ME-1994( )

[A] b+a
[B] b−a
[C] $\frac{b+a}{2}$
[D] $\frac{b-a}{2}$

63) For the differential equation $\frac{dy}{dt} + 5y = 0$ with y(o)=1, the general solution is

2 Marks GATE-ME-1994( )

[A] e^{5t}
[B] e^{-5t}
[C] $5e^{-5t}$
[D] $e^{\sqrt{-5t}}$

64) The solution to the differential equation f''(x)+4f'(x)+4f(x) = 0 is

2 Marks GATE-ME-1995( )

[A] $f_1(x) = e^{-2x}$
[B] $f_1(x) = e^{2x}, f_2(x) = e^{-2x}$
[C] $f_1(x) = e^{-2x}, f_2(x) = e^{-2x}$
[D] $f_1(x) = e^{-2x}, f_2(x) = e^{-x}$

65) For the following set of simultaneous equations :

1.5x−0.5y=2
4x+2y+3z=9
7x+y+5z=10

1 Marks GATE-ME-1997( )

[A] the solution is unique
[B] infinitely many solutions exist
[C] the equations are incompatible
[D] finite number of multiple solutions exist.

66) The particular solution for the differential equation $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 5\ cos\ x$ is

2 Marks GATE-ME-1996( )

[A] 0.5 cos x+1.5 sin x
[B] 1.5 cos x+0.5 sin x
[C] 1.5 sin x
[D] 0.5 cos x

67) If $\phi(x) = \int_0^{x^2} \sqrt{t}\,dt$, then $\frac{d\phi}{dx}$ is

1 Marks GATE-ME-1998( )

[A] $2x^2$
[B] $\sqrt{x}$
[C] 0
[D] 1

68) The general solution of the differential equation $X^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$ is

2 Marks GATE-ME-1998( )

[A] $Ax + Bx^2 \quad (A, B\ are\ constants)$
[B] $Ax + B\ log(x) \quad (A, B\ are\ constants)$
[C] $Ax + Bx^2\ log(x) \quad (A, B\ are\ constants)$
[D] $Ax + Bx\ log(x) \quad (A, B\ are\ constants)$

69) $\frac{\partial^2 u}{\partial t^2} = C^2\frac{\partial^2 u}{\partial x^2}$ represents the equation for

Differential Equations

1 Marks GATE-ME-1999( )

[A] Vibration of a stretched string
[B] motion of a projectile in agravitational field
[C]Heat flow in thin rod
[D]Oscillation of a simple pendulum

70) The partial differential equation $\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} = \frac{\partial^2 u}{\partial x^2}$ is a

1 Marks GATE-ME-2013( )

[A] linear equation of order 2
[B] non-linear equation of order 1
[C]linear equation of order 1
[D]non-linear equation of order 2

71) The function f (t) satisfies the differential equation $\frac{d^2 f}{dt^2} + f = 0$ and the auxiliary conditions, f(o) = 0, $\frac{df}{dt}(0) = 4$. The Laplace transform of f (t) is given by

2 Marks GATE-ME-2013( )

[A] $\frac{2}{s+1}$
[B] $\frac{4}{s+1}$
[C] $\frac{4}{s^2+1}$
[D] $\frac{2}{s^4+1}$

72) The solution to the differential equation $\frac{d^2 u}{dx^2} - k\frac{du}{dx} = 0$ where k is a constant, subjected to the boundary conditions u(0) = 0 and u(L) = U, is

2 Marks GATE-ME-2013( )

[A] $u = U\frac{x}{L}$
[B] $u = U\left(\frac{1-e^{kx}}{1-e^{kL}}\right)$
[C] $u = U\left(\frac{1-e^{-kx}}{1-e^{-kL}}\right)$
[D] $u = U\left(\frac{1+e^{kx}}{1+e^{kL}}\right)$

73) If z = f (x,y),then dz is equal to

1 Marks GATE-ME-2000( )

[A] $\frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy$
[B] $\frac{\partial f}{\partial y}dx + \frac{\partial f}{\partial x}dy$
[C] $\frac{\partial f}{\partial y}dx - \frac{\partial f}{\partial x}dy$
[D] $\frac{\partial f}{\partial y}dx - \frac{\partial f}{\partial x}dy$

74) The solution of the differential equation $\frac{d^2 y}{dx^2} + \frac{dy}{dx} + y = 0$

1 Marks GATE-ME-2000( )

[A] $Ae^{x} + Be^{-x}$
[B] $e^{x}(Ax + B)$
[C] $e^{x}[Acos(\sqrt{3}/2)x + Bcos(\sqrt{3}/2)x]$
[D] $e^{x/2}[Acos(\sqrt{3}/2)x + Bcos(\sqrt{3}/2)x]$

75) $\frac{d^2 y}{dx^2} + (x^2 + 4x)\frac{dy}{dx} + y = x^8 - 8$

The above equation is a

2 Marks GATE-ME-1999( )

[A] partial differential equation
[B] non-linear differential equation
[C]non-homogeneous differential equation
[D]ordinary differential equation.

76) The maximum value of the directional derivative of the function $\phi = 2x^2 + 3y^2 + 5z^2$ at a point (1,1,-1) is

2 Marks GATE-ME-2000( )

[A] 10
[B] -4
[C] $\sqrt{152}$
[D] 152

77) Consider the system of simultaneous equations
x+2y+z=6
2x +y +2z =6
x+y+z=5
This system has

2 Marks GATE-ME-2003( )

[A] unique solution
[B] infinite number of solutions
[C]no solution
[D]exactly two solutions.

78) The solution of the differential equation $\frac{dy}{dx} + y^2 = 0$

2 Marks GATE-ME-2003( )

[A] $y = \frac{1}{x+c}$
[B] $y = \frac{-x^3}{3} + c$
[C] ce^{x}
[D]unsolvable as equation is non-linear.

79) The Blasius equation $\frac{d^3f}{d\eta^3} + \frac{f}{2}\frac{d^2f}{d\eta^2} = 0$ is a

1 Marks GATE-ME-2010( )

[A] second order nonlinear ordinary differential equation

[B] third order nonlinear ordinary different equation

[C] third order linear ordinary differential equation

[D]mixed order nonlinear ordinary differential equation

80) Consider the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - 4y = 0$ with the boundary conditions of y (0)=0 and y (1) =1. The complete solution of the differential equation is

2 Marks GATE-ME-2012( )

[A] x^2

[B] $sin\left(\frac{\pi x}{2}\right)$

[C] $e^x sin\left(\frac{\pi x}{2}\right)$

[D] $e^{-x} sin\left(\frac{\pi x}{2}\right)$

81) Consider the differential equation $\frac{dy}{dx} = (1+y^2)x$. The general solution with constant c is

2 Marks GATE-ME-2011( )

[A] $y = tan\ \frac{x^2}{2} + tan\ c$

[B] $y = tan^2(\frac{x}{2} + c)$

[C] $y = tan^2(\frac{x}{2}) + c$

[D] $y = tan(\frac{x^2}{2} + c)$

82) The solution of $x\frac{dy}{dx} + y = x^4$ with the condition $y(1) = \frac{6}{5}$ is

2 Marks GATE-ME-2009( )

[A] $y = \frac{x^4}{5} + \frac{1}{x}$

[B] $y = \frac{4x^4}{5} + \frac{1}{5x}$

[C] $y = \frac{x^4}{5} + 1$

[D] $y = \frac{x^5}{5} + 1$

83) If $x = a(\theta + sin\theta)$ and $y = a(1 - cos\theta)$, then $\frac{dy}{dx}$ will be equal to

1 Marks GATE-ME-2004( )

[A] $sin\left(\frac{\theta}{2}\right)$

[B] $cos\left(\frac{\theta}{2}\right)$

[C] $tan\left(\frac{\theta}{2}\right)$

[D] $cot\left(\frac{\theta}{2}\right)$

84) The solution of the differential equation $\frac{dy}{dx} + 2xy = e^{-x^2}$ with y(0) = 1 is

1 Marks GATE-ME-2006( )

[A] $(1+x)e^{+x^2}$

[B] $(1+x)e^{-x^2}$

[C] $(1-x)e^{+x^2}$

[D] $(1-x)e^{-x^2}$

85) By a change of variables x(u,v) = u,v,y(u,v) = vlu. in a double integral, the integrand f(x, y) changes to f(u v, u/v) $\phi(u,v)$. Then $\phi(u,v)$ is

2 Marks GATE-ME-2005( )

[A] 2v/u

[B] 2uv

[C] v^2

[D] 1

86) If $x^2\frac{dy}{dx} + 2xy = \frac{2lnx}{x}$, and y(1)=0 ,then what is y(e) ?

2 Marks GATE-ME-2005( )

[A] e

[B] 1

[C] 1/e

[D] $1/e^2$

87) For $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = 3e^{2x}$, the particular integral is

2 Marks GATE-ME-2006( )

[A] $\frac{1}{15}e^{2x}$

[B] $\frac{1}{5}e^{2x}$

[C] $3e^{2x}$

[D] $C_1e^{-x} + C_2e^{-3x}$

88) Given that $\ddot{x}$ + 3x= 0, and x(0) = 1, $\dot{x}$ (0) = 0, what is x (1) ?

1 Marks GATE-ME-2008( )

[A] -0.99

[B] -0.16

[C] 0.16

[D] 0.99

89) The minimum value of function $y = x^2$ in the interval [1 , 5] is

1 Marks GATE-ME-2007( )

[A] 0

[B] 1

[C] 25

[D] undefind

Differential Equations

90) The partial differential equation, $\frac{\partial^2 \varphi}{\partial x^2}+\frac{\partial^2 \varphi}{\partial y^2}+\frac{\partial \varphi}{\partial x}+\frac{\partial \varphi}{\partial y}=0$ has **1 Marks GATE-ME-2007( )**

[A] degree 1 order 2 [B] degree 1 order 1
[C] degree 2 order 1 [D] degree 2 order 2

91) Let $f = y^x$, What is $\frac{\partial^2 f}{\partial x \partial y}$ at x=2, y=1 ? **2 Marks GATE-ME-2008( )**

[A] 0 [B] ln 2
[C] 1 [D] $\frac{1}{ln\ 2}$

92) It is given that $y'' + 2y' + y = 0$, y(0) = 0 y(1) = 0. What is y(0.5) ? **2 Marks GATE-ME-2008( )**

[A] 0 [B] 0.37
[C] 0.62 [D] 1.13

93) If $y = x + \sqrt{x + \sqrt{x + \sqrt{x + ...\infty}}}$, then y(2)= **2 Marks GATE-ME-2007( )**

[A] 4 or 1 [B] 4 only
[C] 1 only [D] undefined

94) The solution of $\frac{dy}{dx} = y^2$ with initial value y(0) = 1 is bounded in the interval **2 Marks GATE-ME-2007( )**

[A] $-\infty \le x \le \infty$ [B] $-\infty \le x \le 1$
[C] x < 1 , x > 1 [D] $-2 \le x \le 2$

Statement for Linked answer Q95 and Q96 is given below

95) The complete solution of the ordinary differential equation $\frac{d^2y}{dx^2}+p\frac{dy}{dx}+qy=0$ is $y = c_1 e^{-x} + c_2 e^{-3x}$.

Q. Then p and q are

2 Marks GATE-ME-2005,GATE-ME-2005( )

[A] p=3,q=3 [B] p=3,q=4
[C] p=4 , q=3 [D] p=4 ,q=4

96) Which of the following is a solution of the differential equation $\frac{d^2y}{dx^2}+p\frac{dy}{dx}+(q+1)y=0$?
2 Marks GATE-ME-2005,GATE-ME-2005( )

[A] e^{-3x} [B] xe^{-x}
[C] xe^{-2x} [D] $x2e^{-2x}$

<u>Differential Equations</u>

Key Paper

1.	**D**	**2.**	**C**	**3.**	**A**	**4.**	**A**	**5.**	**B**
6.	**D**	**7.**	**A**	**8.**	**A**	**9.**	**C**	**10.**	**C**
11.	**A**	**12.**	**D**	**13.**	**D**	**14.**	**D**	**15.**	**C**
16.	**A**	**17.**	**A**	**18.**	**A**	**19.**	**D**	**20.**	**D**
21.	**A**	**22.**	**B**	**23.**	**D**	**24.**	**B**	**25.**	**A**
26.	**C**	**27.**	**B**	**28.**	**A**	**29.**	**C**	**30.**	**C**
31.	**C**	**32.**	**B**	**33.**	**B**	**34.**	**B**	**35.**	**A**
36.	**D**	**37.**	**C**	**38.**	**D**	**39.**	**B**	**40.**	**A**
41.	**A**	**42.**	**C**	**43.**	**D**	**44.**	**C**	**45.**	**B**
46.	**B**	**47.**	**A**	**48.**	**A**	**49.**	**D**	**50.**	**B**
51.	**B**	**52.**	**A**	**53.**	**A**	**54.**	**A**	**55.**	**B**
56.	**D**	**57.**	**D**	**58.**	**D**	**59.**	**C**	**60.**	**B**
61.	**C**	**62.**	**C**	**63.**	**B**	**64.**	**C**	**65.**	**C**
66.	**A**	**67.**	**A**	**68.**	**D**	**69.**	**A**	**70.**	**D**
71.	**C**	**72.**	**B**	**73.**	**A**	**74.**	**D**	**75.**	**D**
76.	**C**	**77.**	**B**	**78.**	**A**	**79.**	**B**	**80.**	**A**
81.	**D**	**82.**	**A**	**83.**	**C**	**84.**	**B**	**85.**	**A**
86.	**D**	**87.**	**B**	**88.**	**B**	**89.**	**B**	**90.**	**A**
91.	**C**	**92.**	**A**	**93.**	**B**	**94.**	**C**	**95.**	**C**
96.	**C**								

Complex Analysis

1) $\oint \frac{z^2-4}{z^2+4}dz$ evaluated anticlockwise around the circle $|z-i|=2$, where $i=\sqrt{-1}$, is

2 Marks GATE-EEE-2013( )

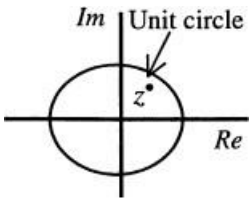
[A] -4Π
[B] 0
[C] $2+\pi$
[D] 2+2i

2) Given $f(z)=\frac{1}{z+1}-\frac{2}{z+3}$ If C is a counterclockwise path in the z-plane such that $|z+1|=1$, the value of $\frac{1}{2\Pi i}P_c f(z)dz$ is

1 Marks GATE-EEE-2012,GATE-ECE/TCE-2012( )

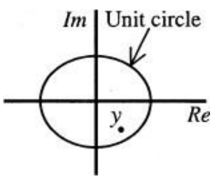
[A] -2
[B] -1
[C] 1
[D] 2

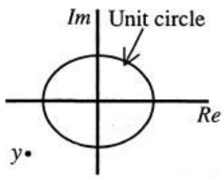
3) A point Z has been plotted in the complex plane, as shown in figure below.

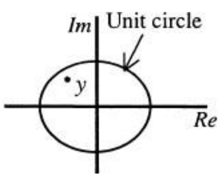


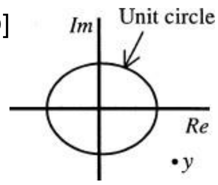
The plot of the complex number $y=\frac{1}{z}$ is

1 Marks GATE-EEE-2011( )

[A]


[B]


[C]


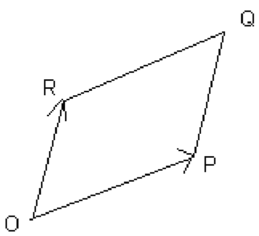
[D]


4) The infinite series $1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+\frac{x^4}{4!}+\ldots\ldots$ corresponds to

1 Marks GATE-CE-2012( )

[A] $see\ x$
[B] e^x
[C] $cos\ x$
[D] $1+sin^2 x$

5) For the parallelogram OPQR shown in the sketch, $\overline{OP}=a\hat{i}+b\hat{j}$ and $\overline{OR}=c\hat{i}+d\hat{j}$. The area of the parallelogram is



2 Marks GATE-CE-2012( )

[A] ad-bc
[B] ac+bd
[C] ad+bc
[D] ab-cd

6) The analytic function $f(z)=\frac{z-1}{z^2+1}$ has singularities at

1 Marks GATE-CE-2009( )

[A] 1 and -1
[B] 1 and i
[C] 1 and -i
[D] i and -i

Complex Analysis

7) The value of the integral $\int_c \frac{cos(2\pi z)}{(2z-1)(z-3)}dz$ (where C is a closed curve given by $|z|=1$) is

2 Marks GATE-CE-2009( )

[A] $-\pi i$ [B] $\frac{\pi i}{5}$

[C] $\frac{2\pi i}{5}$ [D] πi

8) What is the area common to the circles r = a and r = 2a cos θ ?

2 Marks GATE-CE-2006( )

[A] 0.524 a^2 [B] 0.614 a^2

[C] 1.047 a^2 [D] 1.228 a^2

9) The velocity field for flow is given by $\vec{V} = (5x+6y+7z)\hat{i} + (6x+5y+9z)\hat{j} + (3x+2y+\lambda z)\hat{k}$ and the density varies as $\rho = \rho_0$ exp(−21). In order that the mass is conserved, the value of λ should be

2 Marks GATE-CE-2006( )

[A] −12 [B] −10

[C] −8 [D] 10

10) Which one of the following is NOT true for complex number Z_1 and Z_2?

1 Marks GATE-CE-2005( )

[A] $\frac{Z_1}{Z_2} = \frac{Z_1\overline{Z_2}}{|Z_2|^2}$ [B] $|Z_1+Z_2| \le |Z_1| + |Z_2|$

[C] $|Z_1 - Z_2| \le |Z_1| - |Z_2|$ [D] $|Z_1+Z_2|^2 + |Z_1-Z_2|^2 = 2|Z_1|^2 + 2|Z_2|^2$

11) For real values of x, can be written in one of the forms of a convergent series given below :

2 Marks GATE-CE-1997( )

[A] cos (x) = 1 + $\frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!}$....$\infty$ [B] cos (x) = 1 − $\frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^5}{5!}$....$\infty$

[C] cos (x) = x − $\frac{x^3}{3!} + \frac{x^5}{5!} + \frac{x^7}{7!}$....$\infty$ [D] cos (x) = x − $\frac{x^2}{1!} + \frac{x^2}{2!} - \frac{x^3}{3!}$....$\infty$

12) The summation of series
$S = 2 + \frac{5}{2} + \frac{8}{2^2} + \frac{11}{2^3} + ...\infty$

1 Marks GATE-CE-2004( )

[A] 4.50 [B] 6.0

[C] 6.75 [D] 10.0

13) The value of the function $f(x) = \lim_{x\to 0} \frac{x^3+x^2}{2x^3-7x^2}$ is

1 Marks GATE-CE-2004( )

[A] 0 [B] −1/7

[C] 1/7 [D] ∞

14) The function $f(x) = 2x^3 - 3x^2 - 36x + 2$ has its maxima at

2 Marks GATE-CE-2004( )

[A] x = −2 only [B] x = 0 only

[C] x = 3 only [D] both x = − 2 and x = 3

15) The following function has a local minim a at which value of x $f(x) = x\sqrt{5-x^2}$

2 Marks GATE-CE-2002( )

[A] $-\frac{\sqrt{5}}{2}$ [B] $\sqrt{5}$

[C] $\sqrt{\frac{5}{2}}$ [D] $-\sqrt{\frac{5}{2}}$

16) The directional derivative of the following function at (1, 2) in the direction of (4i + 3j) is $f(x,y) = x^2 + y^2$

2 Marks GATE-CE-2002( )

[A] 4/5 [B] 4

[C] 2/5 [D] 1

17) The function $f(x) = e^x$ is

2 Marks GATE-CE-1999( )

[A] Even [B] Odd

[C] Neither even nor odd [D] None of the above

18) If $f(x,y,z) = (x^2+y^2+z^2)^{-\frac{1}{2}}$, $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} + \frac{\partial^2 f}{\partial z^2}$ is equal to

Complex Analysis

2 Marks GATE-CE-2000( )

[A] Zero
[B] 1
[C]2
[D] $-3(x^2+y^2+z^2)$

19) The Taylor expansion of sin x about $x=\pi/6$ is given by

2 Marks GATE-CE-2000( )

[A] $\frac{1}{2}+\frac{\sqrt{3}}{2}\left(x-\frac{\pi}{6}\right)-\frac{1}{4}\left(x-\frac{\pi}{6}\right)^2-\frac{\sqrt{3}}{12}\left(x-\frac{\pi}{6}\right)^3.....$
[B] $x-\frac{x^3}{3!}+\frac{x^5}{5!}-\frac{x^7}{7!}+...$
[C] $\left(x-\frac{\pi}{6}\right)-\frac{\left(x-\frac{\pi}{6}\right)^3}{3!}+\frac{\left(x-\frac{\pi}{6}\right)^5}{5!}-\frac{\left(x-\frac{\pi}{6}\right)7}{7!}+.......$
[D] $\frac{1}{2}$

20) The limit of the function $f(x)=[1-a^4/x^4]$ as $x\to\infty$ is given by

2 Marks GATE-CE-2000( )

[A] 1
[B] $exp(-a^4)$
[C] ∞
[D]Zero

21) The maxima and minima of the function $f(x)=2x^3-15x^2+36x+10$ occur, respectively at

2 Marks GATE-CE-2000( )

[A] X= 3 and x = 2
[B] x = 1 and x = 3
[C] x = 2 and x = 3
[D] x = 3 and x = 4

22) The curve given by the equation $x^2+y^2=3\,axy$, is

1 Marks GATE-CE-1997( )

[A] symmetrical about x – axis
[B] symmetrical about y – axis
[C] symmetrical about line y = x
[D] tangential to x = y = a / 3

23) e^x is periodic, with a period of

1 Marks GATE-CE-1997( )

[A] 2π
[B] $2i\pi$
[C] π
[D] $i\pi$

24) A discontinuous real function can be expressed as

1 Marks GATE-CE-1998( )

[A] Taylor's series and Fourier's series
[B] Taylor's series and not by Fourier's series
[C] neither Taylor's series nor Fourier's series
[D] not by Taylor's series, bu t by Fourier's series

25) The Taylor's series expansion of $sin\ x$ is

1 Marks GATE-CE-1998( )

[A] $1-\frac{x^2}{2!}+\frac{x^4}{4!}$
[B] $1+\frac{x^2}{2!}+\frac{x^4}{4!}$
[C] $x+\frac{x^3}{3!}+\frac{x^5}{5!}$
[D] $x-\frac{x^3}{3!}+\frac{x^5}{5!}$

26) The infinite series $1+\frac{1}{2}+\frac{1}{3}.........$

2 Marks GATE-CE-1998( )

[A] converges
[B] diverges
[C] oscillates
[D] unstable

27) If $x=\sqrt{-1}$, then the value of x^x is :

1 Marks GATE-EIN/IN-2012( )

[A] $e^{-\pi/2}$
[B] $e^{\pi/2}$
[C] X
[D] 1

28) The infinite series $f(x)=x-\frac{x^3}{3!}+\frac{x^5}{5!}-\frac{x^7}{7!}........\infty$ converges to

1 Marks GATE-EIN/IN-2010( )

[A] cos(X)
[B] Sin(x)
[C] Sinh(x)
[D] e^x

29) Consider the function $f(x)=|x|^3$ where x is real. Then the function f(x) at x = 0 is

2 Marks GATE-EIN/IN-2007( )

[A] continuous but not differentiable
[B] once differentiable but not twic
[C] twice differentiable bnut not thrice
[D] thrice differentiable

30) For the function of a complex variable W = ln z (where, W = u + jv and Z = x + jy, the u = constant lines get mapped in Z-plane as

2 Marks GATE-ECE/TCE-2006( )

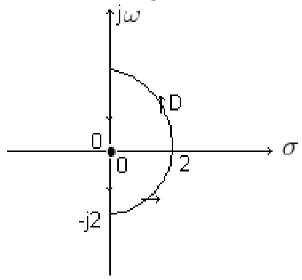
[A] set of radial straight lines
[B] set of concentric circles
[C] set of confocal hyperbolas
[D] set of confocal ellipses

31) The value of the contour integral $\oint_{|z-j|=2} \frac{1}{z^2+4} dz$ in positive sense is

2 Marks GATE-ECE/TCE-2006( )

[A] $j\Pi/2$
[B] $-\Pi/2$
[C] $-j\Pi/2$
[D] $\Pi/2$

32) If the semi-circular contour D of radius 2 is as shown in the figure. Then the value of the integral $\oint_D \frac{1}{(s^2-1)} ds$ is



2 Marks GATE-ECE/TCE-2007( )

[A] jΠ
[B] -jΠ
[C] -Π
[D] Π

33) The equation sin (z) = 10 has

2 Marks GATE-ECE/TCE-2008( )

[A] No real or complex solution
[B] Exactly two distinct complex solutions
[C] A unique solution
[D] An infinite number of complex solutions

34) If $f(z) = c_0 + c_1 z^{-1}$, then $\oint_{Unitcircle} \frac{1+f(z)}{z} dz$ is given by

1 Marks GATE-ECE/TCE-2009( )

[A] $2\Pi c_1$
[B] $2\Pi(1+C_0)$
[C] $2\Pi j C_1$
[D] $2\Pi j(1+C_0)$

35) The value of $\oint_c \frac{dz}{(1+z^2)}$ where C is the contour |z-i/2| =1 is

2 Marks GATE-EEE-2007( )

[A] 2 π i
[B] π
[C] $\tan^{-1} z$
[D] $\Pi i \tan^{-1} z$

36) The function $f(x) = 2x - x^2 - x^3 + 3$ has

2 Marks GATE-EEE-2011( )

[A] a maxima at x = 1 and minimum at x = 5
[B] a maxima at x = 1 and minimum at x = -5
[C] only maxima at x = 1 and
[D] only a minimum at x = 5

37) The residues of a complex function $X(z) = \frac{1-12z}{z(z-1)(z-2)}$ at its poles are

2 Marks GATE-ECE/TCE-2010( )

[A] $\frac{1}{2}, -\frac{1}{2} \text{ and } 1$
[B] $\frac{1}{2}, -\frac{1}{2} \text{ and } -1$
[C] $\frac{1}{2}, 1 \text{ and } -\frac{3}{2}$
[D] $\frac{1}{2}, -1 \text{ and } \frac{3}{2}$

38) The value of the integral $\oint_c \frac{-3z+4}{(z^2+4z+5)} dz$ where c is the circle |z| = 1 is given by

2 Marks GATE-ECE/TCE-2011( )

[A] 0
[B] 1/10
[C] 4/5
[D] 1

39) Let f: A → B be a function, and let E and F be subsets of A. Consider the following statements about images
S1: f(E∪F) = f(E) ∪f(F)
S2: f(E∩F) = f(E) ∩f(F)
Which of the following is true about S1 and S2?

2 Marks GATE-CSE/IT-2001( )

[A] Only S1 is correct
[B] Only S2 is correct
[C]Both S1 and S2 are correct
[D]None of S1 and S2 is correct

40) The residence of the function $f(z) = \frac{1}{(z+2)^2(z-2)^2}$ at z=2 is

1 Marks GATE-ECE/TCE-2008( )

[A] -1/32
[B] -1/16
[C]1/16
[D]1/32

41) The function f(x) = $|x+1|$ on the interval [-2, 0] is

1 Marks GATE-ME-1995( )

[A] continuous and differentiable
[B] continuous on the integral but not differentiable at all points
[C]neither continuous nor differentiable
[D]differentiable but not continuous

42) i^i, where $i = \sqrt{-1}$, is given by

1 Marks GATE-ME-1996( )

[A] 0
[B] $e^{\frac{-\pi}{2}}$
[C] $\frac{\pi}{2}$
[D] 1

43) The magnitude of the gradient of function $f = xyz^3$ at (1,0,2) is

1 Marks GATE-ME-1998( )

[A] 0
[B] 3
[C] 8
[D] ∞

44) What is the derivative of f(x) = x at x = O ?

1 Marks GATE-ME-2001( )

[A] 1
[B] -1
[C]0
[D]Does not exit

45) Which of the following functions is not differentiable in the domain [- 1, 1] ?

1 Marks GATE-ME-2002( )

[A] f(x) = x^2
[B] f(x) = x-1
[C]f(x) = 2
[D]f(x) = maximum (x, -x)

46) A regression model is used to express a variable Y as a function of another variable X.

1 Marks GATE-ME-2002( )

[A] there is a causal relationship between Y and X
[B] a value of X may be used to estimate a value of Y
[C]values of X exactly determine values of Y
[D]there is no causal relationship between Y and X.

47) The minimum point of the function $f(x) = \frac{(x^3)}{3} - x$ is at

2 Marks GATE-ME-2001( )

[A] x=1
[B] x= -1
[C]x = 0
[D] $x = \frac{1}{\sqrt{3}}$

48) The function f(x, y) = $2x^2 + 2xy - y^3$ has

2 Marks GATE-ME-2002( )

[A] only one stationary point at (0, 0)
[B] two stationary points at (0, 0) and and (1/6, -1/3)
[C]two stationary points at (0, 0) and (1, - 1)
[D]no stationary point.

49) The modulus of the complex number $\left(\frac{3+4i}{1-2i}\right)$ is

1 Marks GATE-ME-2010( )

[A] 5
[B] $\sqrt{5}$
[C] $1/\sqrt{5}$
[D] 1/5

50) The function y = $|2-3x|$

1 Marks GATE-ME-2010( )

[A] is continuous $\forall$ x$\in$R and differentiable $\forall$ x$\in$ R
[B] is continuous $\forall$ x$\in$R and differentiable $\forall$ x$\in$ R except at x = 3/2
[C] is continuous $\forall$ x$\in$R and differentiable $\forall$ x$\in$ R except at x = 2/3
[D] is continuous $\forall$ x$\in$R except at x = 3 and differentiable $\forall$ x$\in$R

51) A box contains 2 washers, 3 nuts and 4 bolts. Items are drawn from the box at random one at a time without replacement. The probability of drawing 2 washers first followed by 3 nuts and subsequently the 4 bolts is

Complex Analysis

2 Marks GATE-ME-2010( )

[A]2/315 [B]1/630
[C]1/1260 [D]1/2520

52) Consider the function $f(x) = |x|$ in the interval $-1 \le x \le 1$. At the point $x = 0$, f(x) is

1 Marks GATE-ME-2012( )

[A] continuous and differentiable. [B] non-continuous and differentiable.
[C]continuous and non-differentiable. [D]neither continuous nor differentiable.

53) At $x = 0$, the function $f(x) = x^3 + 1$ has

1 Marks GATE-ME-2012( )

[A] a maximum value [B] a minimum value
[C] a singularity [D] a point of inflection

54) A series expansion for the function $\sin\theta$ is

1 Marks GATE-ME-2011( )

[A] $1 - \frac{\theta^2}{2!} + \frac{\theta^4}{4!} - \ldots\ldots$ [B] $\theta - \frac{\theta^3}{3!} + \frac{\theta^5}{5!} - \ldots\ldots\ldots$
[C] $1 + \theta + \frac{\theta^2}{2!} + \frac{\theta^3}{3!} - \ldots\ldots$ [D] $\theta + \frac{\theta^3}{3!} + \frac{\theta^5}{5!} + \ldots\ldots\ldots$

55) The product of two complex numbers $1 + i$ and $2 - 5i$ is

1 Marks GATE-ME-2011( )

[A]7-3i [B]3-4i
[C]-3-4i [D]7+3i

56) An analytic function of a complex variable $z = x + iy$ is expressed as $f(z) = u(x,y) + iv(x,y)$ where $i = \sqrt{-1}$. If $u = xy$, the expression for v should be

2 Marks GATE-ME-2009( )

[A] $\frac{(x+y)^2}{2} + k$ [B] $\frac{x^2 - y^2}{2} + k$
[C] $\frac{y^2 - x^2}{2} + k$ [D] $\frac{(x-y)^2}{2} + k$

57) The distance between the origin and the point nearest to it on the surface $z^2 = 1 + xy$ is

2 Marks GATE-ME-2009( )

[A] 1 [B] $\frac{\sqrt{3}}{2}$
[C] $\sqrt{3}$ [D]2

58) The volume of an object expressed in spherical co-ordinates is given by

$$V = \int_0^{2\pi}\int_0^{\pi/3}\int_0^1 r^2 \sin\phi \, dr d\phi \, d\theta$$

The value of the integral is

2 Marks GATE-ME-2004( )

[A] $\frac{\pi}{3}$ [B] $\frac{\pi}{6}$
[C] $\frac{2\pi}{3}$ [D] $\frac{\pi}{4}$

59) The divergence of the vector field $(x-y)\hat{i} + (y-x)\hat{j} + (x+y+z)\hat{k}$, is

1 Marks GATE-ME-2008( )

[A]0 [B]1
[C]2 [D]3

60) The integral $\oint f(z)\, dz$ evaluated around the unit circle on the complex plane for $f(z) = \frac{\cos z}{z}$ is

2 Marks GATE-ME-2008( )

[A] $2\pi i$ [B] $4\pi i$
[C] $-2\pi i$ [D]0

61) The length of the curve $y = \frac{2}{3}x^{3/2}$ between x=0 and x=1 is

2 Marks GATE-ME-2008( )

[A]0.27 [B]0.67
[C]1 [D]1.22

Complex Analysis

Key Paper

1.	**A**	**2.**	**C**	**3.**	**D**	**4.**	**B**	**5.**	**A**
6.	**D**	**7.**	**C**	**8.**	**D**	**9.**	**B**	**10.**	**C**
11.	**D**	**12.**	**D**	**13.**	**B**	**14.**	**A**	**15.**	**D**
16.	**B**	**17.**	**B**	**18.**	**A**	**19.**	**A**	**20.**	**A**
21.	**C**	**22.**	**D**	**23.**	**A**	**24.**	**D**	**25.**	**D**
26.	**D**	**27.**	**A**	**28.**	**B**	**29.**	**A**	**30.**	**B**
31.	**D**	**32.**	**A**	**33.**	**A**	**34.**	**D**	**35.**	**B**
36.	**C**	**37.**	**C**	**38.**	**A**	**39.**	**A**	**40.**	**A**
41.	**B**	**42.**	**B**	**43.**	**C**	**44.**	**C**	**45.**	**A**
46.	**B**	**47.**	**A**	**48.**	**B**	**49.**	**B**	**50.**	**C**
51.	**C**	**52.**	**C**	**53.**	**D**	**54.**	**B**	**55.**	**A**
56.	**C**	**57.**	**A**	**58.**	**A**	**59.**	**D**	**60.**	**A**
61.	**A**								

1) The Newton-Raphson method is to be used to find the root of the equation f(x)=0 where x_0 is the initial approximation and f' is the derivative of f. The method converges

1 Marks GATE-CSE/IT-1999( )

[A] always
[B] only if f is a polynomial
[C] only if f(x_0)<0
[D] None of the above

2) The Newton-Raphson method is used to find the root of the equation x^2 -2=0 If the iterations are started form -1, the iterations will

1 Marks GATE-CSE/IT-1997( )

[A] converge to -1
[B] converge to $\sqrt{2}$
[C] converge to - $\sqrt{2}$
[D] not converge

3) Using a forward Euler method to solve y''(t)=f(t), y(0), y''(0)=0 with a step size of h, we obtain the following values of y in the first four iterations:

2 Marks GATE-CSE/IT-1997( )

[A] 0, hf(0), h(f(0) + f(h)) and h(f(0) + f(h) = f(2h))
[B] 0, 0 h2 f(0) and 2h2f(0)+f(h)
[C] 0, 0, h2f(0) 3h2f(0)
[D] 0, 0, hf(0) + h2f(0) and hf (0) + h2f(0)+hf(h)

4) The trapezoidal method to numerically obtain $\int_a^b f(x)$dx has an error E bounded by $\frac{b-a}{12}h^2$ max f''(x) x ∈ [a,b]

where h is the width of the trapezoids. The minimum number of trapezoids guaranteed to ensure E ≤ 10^{-4} is computing in 7 using f = 1/x is

2 Marks GATE-CSE/IT-1997( )

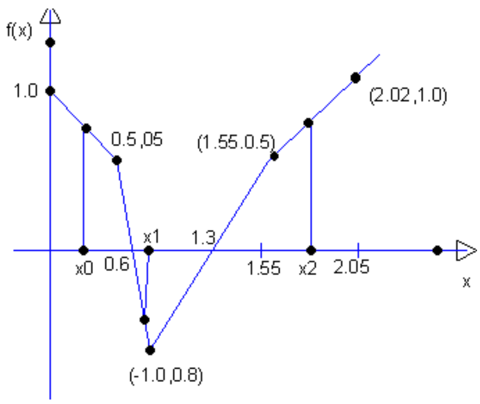
[A] 60
[B] 100
[C] 600
[D] 10000

5) The iteration formula to find the square root of a positive real number b using the Newton Raphson method is

2 Marks GATE-CSE/IT-1995( )

[A] $X_{k+1} = \frac{X_k^2 + b}{2X_k}$
[B] $x_{k+1} = 3(x_k + b)$
[C] $x_{k+1} = x_k - 2x_k/x_k^2 + b$
[D] None of the above

6) A piecewise linear function f(x) is plotted using thick solid lines in the figure below (the plot is drawn to scale).



If we use the Newton-Raphson method to find the roots of f(x)=0 using x0 ,x1 , and x2 respectively as initial guesses ,the obtained would be

2 Marks GATE-CSE/IT-2003( )

[A] 1.3 , 0.6 and 0.6 respectively
[B] 0.6 , 0.6 and 1.3 respectively
[C] 1.3 , 1.3 and 0.6 respectively
[D] 1.3 , 0.6 and 1.3 respectively

7) Simpson's rule for integration gives exact result when f(x) is a polynomial of degree

2 Marks GATE-ECE/TCE-1993( )

[A] 1
[B] 2
[C] 3
[D] 4

8) When the Newton-Raphson method is applied to solve the equation $f(x) = x^3 + 2x - 1 = 0$, the solution at the end of the first iteration with the initial guess value as $x_0 = 1.2$ is

2 Marks GATE-EEE-2013( )

[A]-0.82 [B] 0.49

[C]0.705 [D]1.69

9) Solution of the variables x1 and x2 for the following equations is to be obtained by employing the Newton-Raphson iterative method.
equation(i) $10x_2 sinx_1 - 8 = 0$
equation(ii) $10x_2^2 - 10x_2 cosx_1 - 0.6 = 0$
Assuming the initial valued $x_1 = 0.0$ and $x_2 = 1.0$, the jacobian matrix is

2 Marks GATE-EEE-2011( )

[A] $\begin{bmatrix} 10 & -0.8 \\ 0 & -0.6 \end{bmatrix}$ [B] $\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$

[C] $\begin{bmatrix} 0 & -0.8 \\ 10 & -0.6 \end{bmatrix}$ [D] $\begin{bmatrix} 10 & 0 \\ 10 & -10 \end{bmatrix}$

10) The value of $\int_1^2 \left(\frac{1}{x}\right) dx$ computed using Simpson's rule with a steps size of h=0.25 is:

2 Marks GATE-EEE-1998( )

[A]0.69430 [B] 0.69385

[C]0.69325 [D]0.69415

11) The estimate of $\int_{0.5}^{1.5} \frac{dx}{x}$ obtained using Simpson's rule with three-point function evaluation exceeds the exact values by

1 Marks GATE-CE-2012( )

[A]0.235 [B] 0.068

[C]0.024 [D]0.012

12) The table below gives values of a function F(x) obtained for values of x at intervals of 0.25.

x	0	0.25	0.5	0.75	1.0
F(x)	1	0.9412	0.8	0.64	0.50

The value of the integral of the function between the limits 0 to 1 using Simpson's rule is

2 Marks GATE-CE-2010( )

[A]0.7854 [B] 2.3562

[C]3.1416 [D]7.5000

13) The square root of a number N is to be obtained by applying the Newton Raphson iterations to the equation x^2 – N = 0. If i denotes the iteration index, the correct iterative scheme will be

1 Marks GATE-CE-2011( )

[A] $x_{i+1} = \frac{1}{2}\left(x_i + \frac{N}{x_i}\right)$ [B] $x_{i+1} = \frac{1}{2}\left(x_i^2 + \frac{N}{x_i^2}\right)$

[C] $x_{i+1} = \frac{1}{2}\left(x_i + \frac{N^2}{x_i}\right)$ [D] $x_{i+1} = \frac{1}{2}\left(x_i - \frac{N}{x_i}\right)$

14) In the solution of the following set of linear equations by Gauss elimination using partial pivoting
5x+y+2z=34; 4y-3z=12; and 10x-2y+z=-4;
the pivots for elimination of x and y are

2 Marks GATE-CE-2009( )

[A] 10 and 4 [B] 10 and 2

[C]5 and 4 [D]5 and -4

15) A 2^{nd} degree polynomial, f(x), has values of 1, 4, and 15 at x = O, 1, and 2, respectively. The integral $\int_0^2 f(x)dx$ is to be estimated by applying the trapezoidal rule to this data. What is the error (defined as "true value - approximate value") in the estimate?

2 Marks GATE-CE-2006( )

[A]-4/3 [B]-2/3

[C]0 [D]2/3

16) The following equation needs to be numerically solved using the Newton-Raphson method
$x^3 + 4x - 9 = 0$ The iterative equation for this purpose is (k indicates the iteration level)

2 Marks GATE-CE-2007( )

[A] $x_{k+1} = \frac{2x_k^3+9}{3x_k^2+4}$ [B] $x_{k+1} = \frac{3x_k^3+4}{2x_k^2+9}$

[C] $x_{k+1} = x_k - 3x_k^2 + 4$ [D] $x_{k+1} = \frac{4x_k^2+3}{9x_k^2+2}$

17) Area bounded by the curve y = x^2 and lines x = 4 and y = 0 is given by

1 Marks GATE-CE-1997( )

[A] 64 [B] 64/3
[C] 128/3 [D] 128/4

18) The extremum (minimum or maximum) point of a function f(x) is to be determined by solving $\frac{df(x)}{dx} = 0$ using the Newton – Raphson method . Let $f(x) = x^3 - 6x$ and $x_0 = 1$ be the initial guess of x . The value of x after two iterations (x_2) is

2 Marks GATE-EIN/IN-2011( )

[A] 0.0141 [B] 1.4142
[C] 1.4167 [D] 1.5000

19) For k = 0, 1, 2, ..., the steps of Newton–Raphson method for solving a non-linear equation is given as $x_{k+1} = \frac{2}{3}x_k + \frac{5}{3}x_k^{-2}$
Starting from a suitable initial choice as k tends to ∞, the iterate x_k tends.to

2 Marks GATE-EIN/IN-2006( )

[A] 1.7099 [B] 2.2361
[C] 3.1251 [D] 5.0000

20) Identify the Newton – Raphson iteration scheme for finding the square root of 2.

2 Marks GATE-EIN/IN-2007( )

[A] $x_{n+1} = \frac{1}{2}\left(x_n + \frac{2}{x_n}\right)$ [B] $x_{n+1} = \frac{1}{2}\left(x_n - \frac{2}{x_n}\right)$
[C] $x_{n+1} = \frac{2}{x_n}$ [D] $x_{n+1} = \sqrt{2 + x_n}$

21) Using secant method , the first approximation to the root of the equation $x^2 - 4x - 10 = 0$ with the initial estimates x_1 = 9 and x_2 = 4 is ....

2 Marks ( )

[A] 5.9563 [B] 5.1111
[C] 5.5014 [D] 5.6182

22) Using Newton- Raphson method the first approximation to a real root of the equation $x^5 = 3$ is .... (take initial approximation $x_0 = 1$)

1 Marks ( )

[A] 1.1 [B] 1.2
[C] 1.3 [D] 1.4

23) Starting from x_0 = 1 one step of Newton- Raphson method , in solving the equation $x^3 + 3x - 7 = 0$ gives the next value x_1 as

1 Marks ( )

[A] 0.5 [B] 1.5
[C] 0.75 [D] 1.25

24) Given that $\frac{dy}{dx} = x^2 + y^2$; y(0) = 1 , Find y(0.02) using modified method of Euler . (Take step size h = 0.02)

2 Marks ( )

[A] 1.0424 [B] 1.0204
[C] 1.0324 [D] 1.0414

25) Given that $\frac{dy}{dx} = (1 + xy);\ y(0) = 1$. Using Taylor's Series method find y(0,1) by considering the Taylor's Series expansion upto h^2 term (take h = 0.5)

2 Marks ( )

[A] 1.011 [B] 1.115
[C] 1.015 [D] 1.105

26) Given that $\frac{dy}{dx} = (1 + xy);\ y(0) = 1$. Using Taylor's Series method find y(0,1) by considering the Taylor's Series expansion upto h^2 term (take h = 0.5)

2 Marks ( )

[A] 1.011 [B] 1.115
[C] 1.015 [D] 1.105

27) The first approximation of $xe^{x^{-2}} = 0$, which lies in [0, 1] by using Regula – falsi method is

1 Marks ( )

[A]0.7676 [B] 0.7353

[C]0.7962 [D]0.4632

28) The initial approximation of 3x = cos x + 1 is 1 , then the first approximation by using Newton- Raphson method is

2 Marks ( )

[A]0.6338 [B] 0.6200

[C]0.6093 [D]0.6123

29) If 'n' is the number of sub-intervals then which of the following is not a value for 'n' to use Simpson's 3/8 rule

1 Marks ( )

[A]6 [B] 9

[C]12 [D]16

30) Using the bisection method find the negative root of $x^3 - 4x + 9 = 0$ correct to the three decimal places

2 Marks ( )

[A]- 2.506 [B] -2.706

[C]-2.406 [D]None

31) Use Secant method to determine the root of the equation $cos\ x = xe^x$ with initial approximation $x_0 = 0$ and $x_1 = 1$. What is x_2?

2 Marks ( )

[A]1 [B]- 2.178

[C]0.3147 [D]0.4467

32) Match the following and choose the correct combination

Group-I	Group-II
E. Newton-Raphson method	1. Solving nonlinear equations
F. Rung-kutta method	2. Solving linear simultaneous equations
G. Simpson's Rule	3. Solving ordinary differential equations
H. Gauss elimination	4. Numerical integration
	5. Interpolation
	6. Calculation of Eigen values

2 Marks GATE-ECE/TCE-2005( )

[A]E-6, F-1, G-5, H-3 [B] E-1, F-6, G-4, H-3

[C]E-1, F-3, G-4, H-2 [D]E-5, F-3, G-4, H-1

33) The equation $x^3 - x^2 + 4x - 4 = 0$ is to be solved using the Newton-Raphson method. If x = 2 is taken as the initial approximation of the solution, then the next approximation using this method will be

2 Marks GATE-ECE/TCE-2007( )

[A]2/3 [B] 4/3

[C]1 [D]3/2

34) The recursion relation to solve x = e^{-x} using Newton Raphson method is

2 Marks GATE-ECE/TCE-2008( )

[A] $x_{n+1} = e^{-x_n}$ [B] $x_{n+1} = x_n - e^{-x_n}$

[C] $x_{n+1} = (1 + x_n)\dfrac{e^{-x_n}}{1 + e^{-x_n}}$ [D] $X_{n+1} = \dfrac{X_n^2 - e^{X_n}(1 + X_n) - 1}{X_n - e^{-X_n}}$

35) Function f is known at the following points:

x	0	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0
f(x)	0	0.09	0.36	0.81	1.44	2.25	3.24	4.41	5.76	7.29	9.00

The value of $\int_0^3$ f(x)dx computed using the trapezoidal rule is

1 Marks GATE-CSE/IT-2013( )

[A] 8.983 [B] 9.003
[C] 9.017 [D] 9.045

36) Newton-Raphson method is used to compute a root of the equation $x^2 - 13 = 0$ with 3.5 as the initial value. The approximation after one iteration is

1 Marks GATE-CSE/IT-2010( )

[A] 3.575 [B] 3.676
[C] 3.667 [D] 3.607

37) A numerical solution of the equation $f(x) = x + \sqrt{x} - 3 = 0$ can be obtained using Newton - Raphson method. If the starting values is x = 2 for the iteration, the value of x that is to be used in the next step is

2 Marks GATE-ECE/TCE-2011( )

[A] 0.306 [B] 0.739
[C] 1.694 [D] 2.306

38) Let $x^2 - 117 = 0$. The iterative steps for the solution using Newton-Raphson's method is given by

2 Marks GATE-EEE-2009( )

[A] $x_{k+1} = \frac{1}{2}\left(x_k + \frac{117}{x_k}\right)$ [B] $x_{k+1} = x_k - \frac{117}{x_k}$
[C] $x_{k+1} = x_k - \frac{x_k}{117}$ [D] $x_{k+1} = x_k - \frac{1}{2}\left(x_k + \frac{117}{x_k}\right)$

39) The trapezoidal rule for integration gives exact result when the integrand is a polynomial of degree

1 Marks GATE-CSE/IT-2002( )

[A] 0 but not 1 [B] 1 but not 0
[C] 0 or 1 [D] 2

40) The Newton-Raphson iteration $X_{n+1} = \left(\frac{X_n}{2} + \frac{3}{(2X_n)}\right)$ can be used to solve the equation

2 Marks GATE-CSE/IT-2002( )

[A] $x^2 = 3$ [B] $x^3 = 3$
[C] $x^2 = 2$ [D] $x^3 = 2$

41) Which of the following is useful for solving algebraic equations

1 Marks ( )

[A] Euler's method [B] Coulombs method
[C] Simpson's Rule [D] Newton Raphson method

42) The N-R method for finding roots of f(x)=0 converging to the root

1 Marks ( )

[A] If f(x) is polynomial [B] If $f'(x_0) > 0$
[C] Converges always [D] none of these

43) The N-R iteration formula for Square root of 'C' where c >0

1 Marks ( )

[A] $x_{n+1} = \frac{x_n^2 + c}{x_n}$ [B] $x_{n+1} = \frac{x_n^2 + c}{2x_n}$
[C] $x_{n+1} = \frac{x_n^2 - c}{2x_n}$ [D] $x_{n+1} = \frac{x_n^2 - c}{x_n}$

44) N-R formula $x_{n+1} = \frac{1}{2}\left(x_n + \frac{R}{x_n}\right)$ evaluates

1 Marks ( )

[A] Square of R [B] Logarithm of R
[C] Reciprocal of R [D] Square root of R

45) $f(x) = x^5 + x + 2 = 0$ has

1 Marks ( )

[A] All complex roots
[B] All real roots
[C] 1 real & 4 complex roots
[D] 2 real roots & 3 complex roots

46)

x	0	0.25	0.5	0.75	1.00
f(x)	1	0.9412	0.8	0.64	0.50

The value of the integral of the function between the limit 0 to 1 using simpson's rule is

2 Marks ( )

[A] 0.7854
[B] 2.3562
[C] 3.1416
[D] 7.5000

47) Newton-Raphson iteration formula for finding $\sqrt[3]{C}$, where c > 0 is

1 Marks ( )

[A] $x_{n+1} = \frac{2x_n^3 + \sqrt[3]{c}}{3x_n^2}$
[B] $x_{n+1} = \frac{2x_n^3 - \sqrt[3]{c}}{3x_n^2}$
[C] $x_{n+1} = \frac{2x_n^3 + C}{3x_n^2}$
[D] $x_{n+1} = \frac{2x_n^2 - c}{3x_n^2}$

48) For $\frac{dy}{dx} = xy$ given that y = 1 at x = 0. Using Euler method taking the step size 0.1, the y at x = 0.4 is

2 Marks ( )

[A] 1.0611
[B] 2.4680
[C] 1.6321
[D] 2.4189

49) The root of the equation $x^3 - 4x - 9 = 0$ using the bisection method in 4 stages

2 Marks ( )

[A] 2.4065
[B] 2.6875
[C] 2.750
[D] None of the above

50) The Newton-Raphson iteration $x_{n+1} = \frac{x_n}{2} + \frac{3}{2x_n}$ can be used to solve the equation

1 Marks ( )

[A] $x^2 = 3$
[B] $x^3 = 3$
[C] $x^2 = 2$
[D] $x^3 = 2$

51) The 2's complement representation of (– 539)10 is hexadecimal is

1 Marks ( )

[A] ABE
[B] DBC
[C] DE5
[D] 9E7

52) The decimal value of 0.2

1 Marks ( )

[A] is equivalent to the binary value 0.1
[B] is equivalent to the binary value 0.01
[C] is equivalent to the binary value 0.00111.....
[D] cannot be represented precisely in binary

53) Minimum number of equivalent sub intervals needed to approximate $\int_1^2 x\, e^x\, dx$ to an accuracy at least $\frac{1}{3} \times 10^{-6}$ using Trapezoidal rule

2 Marks ( )

[A] 1000 e
[B] 100
[C] 100 e
[D] 1000

54) The order of error is the Simpson's rule for numerical integration with a step size h is

1 Marks GATE-ME-1997( )

[A] h
[B] h^2
[C] h^3
[D] h^4

55) Following are the values of a function y(x) : y(-1)=5 , y(o) , $y(1) = 8\frac{dy}{dx}$ at x=0 as per Newton's central difference is

1 Marks GATE-ME-1999( )

[A] 0 | [B] 1.5
[C] 2.0 | [D] 3.0

56) Match the CORRECT pairs.

Numerical Integration Scheme	Order of Fitting Polynomial
P. Simpson's 3/8 Rule	1. First
Q. Trapezoidal Rule	2. Second
R. Simpson's 1/3 Rule	3. Third

1 Marks GATE-ME-2013( )

[A] P-2, Q-1, R-3 | [B] P-3, Q-2, R-1
[C] P-1, Q-2, R-3 | [D] P-3, Q-1, R-2

57) We wish to solve $x^2 - 2 = 0$ by Newton Raphson technique. Let the initial guess b $x_0 = 1.0$. Subsequent estimate of x (i.e. x_1) will be

2 Marks GATE-ME-1999( )

[A] 1.414 | [B] 1.5
[C] 2.0 | [D] none of these

58) The accuracy of Simpson's rule quadrature for a step size h is

1 Marks GATE-ME-2003( )

[A] $O(h^2)$ | [B] $O(h^3)$
[C] $O(h^4)$ | [D] $O(h^5)$

59) The values of a function f(x) are tabulated below

x	0	1	2	3
f(x)	1	2	1	10

Using Newton's forward difference formula, the cubic polynomial that can be fitted to the above data, is

2 Marks GATE-ME-2004( )

[A] $2x^3+7x^2-6x+2$ | [B] $2x^3-7x^2-6x-2$
[C] x^3-7x^2-6x+1 | [D] $2x^3-7x^2+6x+1$

60) Starting from $x_0 = 1$ one step of Newton- Raphson method in solving the equation $x^3 + 3x - 7$ gives the next value (x_1) as

2 Marks GATE-ME-2005( )

[A] x_1=0.5 | [B] x_1=1.406
[C] x_1=1.5 | [D] x_1=2

Statement for Linked answer Q61 and Q62 is given below

61) Given a >0, we wish to calculate its reciprocal value $\frac{1}{a}$ by using Newton Raphson method for f(x) = 0

2 Marks GATE-CE-2005,GATE-CE-2005( )

[A] $X_{K+1} = \frac{1}{2}\left(X_K + \frac{a}{X_K}\right)$ | [B] $X_{K+1} = \left(X_K + \frac{a}{2}X_K^2\right)$
[C] $X_{K+1} = 2X_K - aX_K^2$ | [D] $X_{K+1} = X_K - \frac{a}{2}X_K^2$

62) For a = 7 and starting with xo= 0.2, the first two iterations will

2 Marks GATE-CE-2005( )

[A] 0.11, 0.1299 | [B] 0.12, 0.1392
[C] 0.12, 0.1416 | [D] 0.13, 0.1428

Numerical Methods

Key Paper

1.	D	2.	C	3.	D	4.	C	5.	A
6.	B	7.	C	8.	C	9.	B	10.	C
11.	D	12.	A	13.	A	14.	A	15.	A
16.	A	17.	B	18.	B	19.	A	20.	A
21.	B	22.	D	23.	B	24.	B	25.	D
26.	D	27.	B	28.	B	29.	D	30.	B
31.	B	32.	C	33.	B	34.	C	35.	D
36.	D	37.	C	38.	A	39.	C	40.	A
41.	D	42.	D	43.	B	44.	D	45.	C
46.	A	47.	C	48.	A	49.	B	50.	A
51.	C	52.	D	53.	A	54.	B	55.	B
56.	D	57.	D	58.	D	59.	D	60.	C
61.	C	62.	B						

Probability & Statistics

1) Let P(E) denote the probability of the event E.Given P(A) = 1 , P(B) = 1/2 , the values of P(A|B) and P(B|A) respectively are

1 Marks GATE-CSE/IT-2003( )

[A] 1/4, 1/2 | [B] 1/2 , 1/4
[C] 1/2 , 1 | [D] 1 , 1/2

2) A polynomial p(r) is such that p(0) = 5, p(1) = 4, p(2) = 9 and P(3) =20 The minimum degree it can have is

2 Marks ( )

[A] 1 | [B] 2
[C] 3 | [D] 4

3) Two events A and B with probability 0.5 and 0.7 respectively, have joint probability of 0.4 . The probability that neither A or B happens is

2 Marks DRDO-ECE/TCE-2008( )

[A] 0.2 | [B] 0.4
[C] 0.6 | [D] 0.8

4) There are two fair coins $\left((PHead) = P(Tail) = \frac{1}{2}\right)$ and a third biased coin where $P(Head) = \frac{1}{4}$ and $P(Tail) = \frac{3}{4}$. One coin is picked at random and tossed once a Head is obtained . The probability that the coin tossed is one of the fair coins is

2 Marks DRDO-ECE/TCE-2009( )

[A] $R_x(\tau) = \begin{cases} 1, & |\tau| \le 1 \\ 0, & otherwise \end{cases}$ | [B] $R_x(\tau) = \frac{sin\tau}{2\tau}$
[C] $R_x(\tau) = 1 - sin^2\tau$ | [D] $R_x(\tau) = \begin{cases} 1-|\tau| & |\tau| \le 1 \\ 0, & otherwise \end{cases}$

5) A probability density function is given by
$p(x) = Ke^{-x^2/2} - \infty < x < \infty$

The value of K should be

2 Marks GATE-ECE/TCE-1997( )

[A] $\frac{1}{\sqrt{2\Pi}}$ | [B] $\sqrt{\frac{2}{\Pi}}$
[C] $\frac{1}{2\sqrt{\Pi}}$ | [D] $\frac{1}{\pi\sqrt{2}}$

6) The function $f(X,Y) = X^2Y - 3XY + 2Y + X$, has

2 Marks GATE-ECE/TCE-1993( )

[A] no local extremum | [B] one local minimum but no local maximum
[C] one local maximum but no local minimum | [D] one local minimum but no local minimum

7) An event has two possible outcomes with probability $P_1 = \frac{1}{2}$ and $P_2 = \frac{1}{64}$ The rate of information with 16 outcomes per second is:

1 Marks IES-ECE/TCE-2013( )

[A] $\frac{38}{4}$ bits/sec | [B] $\frac{38}{64}$ bits/sec
[C] $\frac{38}{2}$ bits/sec | [D] $\frac{38}{32}$ bits/sec

8) Two independent random variables X and y are uniformly distributed in the interval [-1 1]. The probability that max[X y] is less than 1/2 is

1 Marks GATE-EEE-2012,GATE-ECE/TCE-2012( )

[A] 3/4 | [B] 9/16
[C] 1/4 | [D] 2/3

9) Two coins are simultaneously tossed.The probability of two heads simultaneously appearing is

1 Marks GATE-CE-2010( )

[A] 1/8 | [B] 1/6
[C] 1/4 | [D] 1/2

10) In an experiment, positive and negative values are equally likely to occur. The probability of obtaining at most one negative value in five trials is

2 Marks GATE-CE-2012( )

[A] $\frac{1}{32}$ | [B] $\frac{2}{32}$
[C] $\frac{3}{32}$ | [D] $\frac{6}{32}$

11) There are two containers, with one containing 4 Red and 3 Green balls and the other containing 3 Blue and 4 Green balls. One ball is drawn at random from each container. The probability that one of the balls is Red and the other is Blue will be

1 Marks GATE-CE-2011( )

[A] 1/7 [B] 9/49
[C] 12/49 [D] 3/7

12) A class of first year B.Tech. students is composed of four batches A, B, C and D, each consisting of 30 students. It is found that the sessional marks of students in Engineering Drawing in batch C have a mean of 6.6 and standard deviation of 2.3. The mean and standard deviation of the marks for the entire class are 5.5 and 4.2, respectively. It is decided by the course instructor to normalize the marks of the students of all batches to have the same mean and standard deviation as that of the entire class. Due to this, the marks of a stu-dent in batch C are changed from 8.5 to

2 Marks GATE-CE-2006( )

[A] 6.0 [B] 7.0
[C] 8.0 [D] 9.0

13) The standard normal probability function can be approximated as

$$F(x_N) = \frac{1}{1 + exp(-1.7255 x_N |x_N|^{0.12})}$$

where x_N = standard normal deviate. If mean and standard deviation of annual precipitation are 102 em and 27 em respectively, the probability that the annual precipitation will be between 90 em and 102 em is

2 Marks GATE-CE-2009( )

[A] 66.7% [B] 50.0%
[C] 33.3% [D] 16.7%

14) If probability density function of a random variable X is
$f(x) = x^2$ for $-1 \le x \le 1$, and
= 0 for any other value of x
Then, the percentage probability $p\left(-\frac{1}{3} \le x \le \frac{1}{3}\right)$ is

2 Marks GATE-CE-2008( )

[A] 0.247 [B] 2.47
[C] 24.7 [D] 247

15) A person on a trip has a choice between private car and public transport. The probability of using a private car is 0.45. While u s.ing the public transport, further choices available are bus and metro, out of which the probability of commuting by a bus is 0.55. In such a situation, the probability (rounded up to two decimals) of using a car, bu s and metro, respectively would be

2 Marks GATE-CE-2008( )

[A] 0.45, 0.30 and 0.25 [B] 0.45, 0.25 and 0.30
[C] 0.45, 0.55 and 0.00 [D] 0.45, 0.35 and 0.20

16) A hydraulic structure has four gates which operate independently. The probability of failure of each gate is 0.2. Given that gate 1 has failed, the probability that both gates 2 and 3 will fail is

2 Marks GATE-CE-2004( )

[A] 0.240 [B] 0.200
[C] 0.040 [D] 0.008

17) A box contains 10 screws, 3 of which are defective. Two screws are drawn at random with replacement. The probability that none of the two screws is defective will be

1 Marks GATE-CE-2003( )

[A] 100% [B] 50%
[C] 49% [D] None of these

18) The probability that the load on a scaffolding will exceed the design load of 3 tonnes is 0.15. At the same time, the probability that the strength of the scaffolding will be more than 3tonnes is 0.85. The probability that the scaffolding will fail is

2 Marks IES-CE-2002( )

[A] 0.2775 [B] 0.1275
[C] 0.0225 [D] 0.0020

19) The probability that the load on a scaffolding will exceed 2t is 0.15. The probability that the strength of the scaffolding will be more than 2t is 0.8. The probability of failure of the scaffolding will be

2 Marks IES-CE-2000( )

[A]0.68 [B] 0.17
[C]0.12 [D]0.03

20) From the probability equation it is found that the most probable values of a series of errors arising out of observations of equal weightage are those for which the sum of their squares is

2 Marks IES-CE-2003( )

[A] Zero [B] infinity
[C]minimum [D]maximum

21) The box 1 contains chips numbered 3 , 6 , 9 , 12 and 15 . The box 2 contains chips numbered 6 , 11 , 16 , 21 and 26 . Two chips , one from each box , are drawn at random.The numbers . The numbers written on these chips are multiplied . The probability for the to be even number is

2 Marks GATE-EIN/IN-2011( )

[A]6/25 [B] 2/5
[C]3/5 [D]19/25

22) A continuous random variable X has a probability density function f (x) = e^{-x} , 0 <x <∞. Then P{X >1} is

1 Marks GATE-EIN/IN-2013( )

[A]0.368 [B]0.5
[C]0.632 [D]1.0

23) A fair coin is tossed till a head appears for the first time . The probability that the number of required tosses is odd , is :

1 Marks GATE-EIN/IN-2012( )

[A]1/3 [B] 1/2
[C]2/3 [D]3/4

24) Two dices are rolled simultaneously. The probability that the sum of digits on the top surface of the two dices is even is

2 Marks GATE-EIN/IN-2006( )

[A]0.5 [B]0.25
[C]0.167 [D]0.125

25) A random variable X has $\bar{X} = 0$ & $\sigma_x^2 = 1$. Form a new random variable Y = 2x + 1 . The values of $\bar{Y}$ & σ_Y^2 are :

2 Marks ISRO-ECE/TCE-2012( )

[A]0 &1 [B] 1 &2
[C]1 &4 [D]None of these

26) Person X can solve 80 % of the ISRO and person Y can solve 60 % . The probability that at least one of them will solve a problem from the question paper , selected at random is :

2 Marks ISRO-ECE/TCE-2012( )

[A]0.48 [B] 0.70
[C]0.88 [D]0.92

27) A man with n keys wants to open a clock . He tries his keys at random . The expected number of attempts for this success is (keys are replaced after every attempt)

2 Marks ISRO-ECE/TCE-2009( )

[A] n/2 [B] n
[C]$\sqrt{n}$ [D]None of the above

28) A husband and wife appear in an interview for two vacancies for same post . The probability of husband getting selected is 1/5 while the probability of wife getting selected is 1/7 . Then the probability that anyone of them getting selected is

2 Marks ISRO-ECE/TCE-2008( )

[A]11/35 [B] 12/35
[C]1/35 [D]34/35

29) A bag contains eight white and six red marbles . The probability of drawing two marbles of same colour is

2 Marks ISRO-ECE/TCE-2007( )

[A]$\frac{8c_2.6c_2}{14c_2}$ [B]$\frac{8c_2}{14c_2} + \frac{6c_2}{14c_2}$
[C]$\frac{8c_2.6c_2}{14c_2.14c_2}$ [D]$\frac{8c_2}{14c_2} + \frac{6c_2}{12c_2}$

30) A box contains 5 black and 5 red balls . Two balls are randomly picked one after another from the box, without replacement . The probability for both balls being red is

2 Marks ISRO-ECE/TCE-2006( )

[A] 1 / 90 [B] 1 / 5
[C] 19 / 90 [D] 2 / 9

31) If A and B are two events and P(A / B) = 1 then $P(B^c/A^c)$ is

1 Marks ( )

[A] $P(B^c)$ [B] $P(A^c)$
[C] 0 [D] 1

32) The regression equations are x + 2y = 3 ; 2x + 3y = 4 then E(X) , E(Y) are

1 Marks ( )

[A] - 1 , -2 [B] 1 , -2
[C] 2, 1 [D] -1 , 2

33) From 6 positive and 8 negative numbers , 4 numbers are chosen at random (without replacement) and multiplied , the probability that the product is a positive number is

2 Marks ( )

[A] $\frac{505}{1001}$ [B] $\frac{50}{1001}$
[C] $\frac{5}{101}$ [D] 55 / 1001

34) The probability of error on a single transmission in a digital communication system is 10^{-4}. Then the probability of more than three errors in 1000 transmissions is

2 Marks ( )

[A] 2×10^{-6} [B] 3×10^{-6}
[C] 4×10^{-6} [D] 5×10^{-6}

35) The regression equations are 2x + 3y = 6 ; 4x + 3y = 6 then the correlation coefficient is ....

2 Marks ( )

[A] 1 / 2 [B] 2
[C] - 1 / 2 [D] $1/\sqrt{2}$

36) A problem is given to three students A, B and C ; whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively . The probability that the problem will be solved by at least one of them is

1 Marks ( )

[A] $\frac{1}{4}$ [B] $\frac{2}{3}$
[C] $\frac{3}{4}$ [D] $\frac{4}{5}$

37) A and B are two independent events with $P(A \cup B)$ = 0.8 and P(A) = 0.5 then P(B) =

1 Marks ( )

[A] 0.3 [B] 0.4
[C] 0.1 [D] 0.6

38) A party of 'n' persons take their seats at random at a round table , then the probability that two specified persons do not sit together is

2 Marks ( )

[A] $\frac{2}{(n-1)}$ [B] $\frac{(n-3)}{(n-1)}$
[C] $\frac{(n-2)}{(n-1)}$ [D] $\frac{1}{(n-1)}$

39) A manufacturer knows that the condensers he makes contain on an average 1% defectives . He packs them in boxes of 100 . What is the probability that a box picked up at random will contain 3 or more faulty condensers ?

2 Marks ( )

[A] $1 - \frac{3}{2}e^{-1}$ [B] $1 - \frac{5}{2}e^{-1}$
[C] $1 - \frac{2}{e}$ [D] $1 - \frac{5}{e}$

40) In a series of independent trials with the result of each trial being classified either a success or failure , the probability of a success in a trail is 1 / 3 . The probability that the fifth trail results in the third success is

2 Marks ( )

[A] 8 / 81 [B] 40 / 243

[C]1/27 [D]4/243

41) A gambler has in his pocket a fair coin and a two headed coin. He selects one of the coins at random and flips it and it shows head. The probability that it is the fair coin is

2 Marks ( )

[A]1/4 [B] 3/4
[C]1/3 [D]2/3

42) A man takes a step forward with probability 0.4 and backward with probability 0.6. The probability that at the end of 11 steps he is one step away from the starting point is

2 Marks ( )

[A] $\left(\frac{6}{25}\right)^5$ [B] $462\left(\frac{6}{25}\right)^5$
[C] $538\left(\frac{1}{25}\right)^5$ [D] $\left(\frac{1}{25}\right)^5$

43) Out of 10,000 families with 4 children each the probable number of families, all of whose children are daughters is

2 Marks ( )

[A]1250 [B]625
[C]2500 [D]9375

44) If A and B are mutually exclusive events, then

1 Marks ( )

[A] $P(A \cup B) = P(A).P(B)$ [B] $P(A \cap B) = P(A).P(B)$
[C] $P(A \cup B) = 0$ [D] $P(A \cap B) = 0$

45) The variance of the two-point distribution

X	A	b
F(x)	P	q

where p + q = 1 is

1 Marks ( )

[A] ap + bq [B] $\sqrt{ap+bq}$
[C] $pq(a-b)^2$ [D]2pq

46) A fair dice is rolled twice. The probability that an odd number will follow an even number is

2 Marks GATE-ECE/TCE-2005( )

[A]1/2 [B] 1/4
[C]1/6 [D]1/3

47) A probability density function is of the form

$$p(x) = Ke^{-\alpha x}, x \epsilon (-\infty, \infty)$$

The value of K is

2 Marks GATE-ECE/TCE-2006( )

[A]0.5 [B] 1
[C]0.5 α [D] α

48) An examination consists of two papers. Paper 1 and Paper 2. The probability of failing in Paper 1 is 0.3 and that in Paper 2 is 0.2. Given that a student has failed in Paper 2, the probability of failing in Paper 1 is 0.6. The probability of a student failing in both the papers is

2 Marks GATE-ECE/TCE-2007( )

[A]0.5 [B] 0.18
[C]0.12 [D]0.06

49) A fair coin is tossed 10 times. What is the probability that Only the first two tosses will yield heads?

1 Marks GATE-ECE/TCE-2009( )

[A] $\left(\frac{1}{2}\right)^2$ [B] ${}^{10}C_2\left(\frac{1}{2}\right)^2$
[C] $\left(\frac{1}{2}\right)^{10}$ [D] ${}^{10}C_2\left(\frac{1}{2}\right)^{10}$

50) If P and Q are two random events, then the following is TRUE

2 Marks GATE-EEE-2005( )

[A] Independence of P and Q implies that probability ($P \cap Q$) = 0

[B] Probability (P U Q) ≥ Probability (P) + Probability (Q)

[C] If P and Q are mutually exclusive, then they must be independent

[D] Probability ($P \cap Q$) ≤ Probability (P)

51) A fair coin is tossed three times in succession. If the first toss produces a head, then the probability of getting exactly two heads in three tosses is

2 Marks GATE-EEE-2005( )

[A] 1/8

[B] 1/2

[C] 3/8

[D] 3/4

52) Two fair dice are rolled and the sum r of the numbers turned up is considered

2 Marks GATE-EEE-2006( )

[A] $Pr(r > 6) = \frac{1}{6}$

[B] $Pr(r/3 \text{ is an integer}) = \frac{5}{6}$

[C] $Pr(r = 8 \mid r/4 \text{ is an integer}) = \frac{5}{9}$

[D] $Pr(r = 6 \mid r/5 \text{ is an integer}) = \frac{1}{18}$

53) X is a uniformly distributed random variable that takes values between 0 and 1. The value of $E\{X^3\}$ will be

2 Marks GATE-EEE-2008( )

[A] 0

[B] 1/8

[C] 1/4

[D] 1/2

54) Consider an undirected random graph of eight vertices. The probability that there is an edge between a pair of vertices is 1/2. What is the expected number of unordered cycles of length three?

1 Marks GATE-CSE/IT-2013( )

[A] 1/8

[B] 1

[C] 7

[D] 8

55) A continuous random variable X has a probability density function $f(x) = e^{-x}, 0 < x < \infty$. Then P{X>1} is

1 Marks GATE-EEE-2013( )

[A] 0.368

[B] 0.5

[C] 0.632

[D] 1.0

56) The minimum Eigen value of the following matrix is

$$\begin{bmatrix} 3 & 5 & 2 \\ 5 & 12 & 7 \\ 2 & 7 & 5 \end{bmatrix}$$

1 Marks GATE-ECE/TCE-2013( )

[A] 0

[B] 1

[C] 2

[D] 3

57) Suppose p is number of cars per minute passing through a certain road junction between 5 PM and 6PM, and p has a Poisson distribution with mean 3. What is the probability of observing fewer than 3 cars during any given minute in this interval?

1 Marks GATE-CSE/IT-2013( )

[A] $8/(2e^3)$

[B] $9/(2e^3)$

[C] $17/(2e^3)$

[D] $26/(2e^3)$

58) Consider a random variable X that takes values + 1 and −1 with probability 0.5 each. The values of the cumulative distribution function F(x) at x = −1 and +1 are

1 Marks GATE-CSE/IT-2012( )

[A] 0 and 0.5

[B] 0 and 1

[C] 0.5 and 1

[D] 0.25 and 0.75

59) If the difference between the expectation of the square of random variable $(E[X^2])$ and the square of the expectation of the random variable $(E[X^2])$ is denoted by R then

1 Marks GATE-CSE/IT-2011( )

[A] R = 0

[B] R<0

[C] $R \geq 0$

[D] R>0

60) If two fair coins are flipped and at least one of the outcomes is known to be a head, what is the probability that both outcomes are heads?

1 Marks GATE-CSE/IT-2011( )

[A] 1 / 3 [B] 1 / 4
[C] 1 / 2 [D] 2 / 3

61) A fair coin is tossed independently four times. The probability of the event " the number of time heads shown up is more than the number of times tails shown up" is

2 Marks GATE-ECE/TCE-2010( )

[A] $\frac{1}{16}$ [B] $\frac{1}{8}$
[C] $\frac{1}{4}$ [D] $\frac{5}{16}$

62) Consider the methods used by processes P1 and P2 for accessing their critical sections whenever needed, as given below. The initial values of shared boolean variables S1 and S2 are randomly assigned.

Method used by PI	Method used by P2
while (S1 = = S2) ; Critica1 Section S1 = S2;	while (S1 != S2) ; Critica1 Section S2 = not (S1);

Which one of the following statements describes the properties achieved?

1 Marks GATE-CSE/IT-2010( )

[A] Mutual exclusion but not progress [B] Progress but not mutual exclusion
[C] Neither mutual exclusion nor progress [D] Both mutual exclusion and progress

63) Consider a company that assembles computers. The probability of a faulty assembly of any computer is p. The company therefore subjects each computer to a testing process. This testing process gives the correct result for any computer with a probability of q. What is the probability of a computer being declared faulty?

2 Marks GATE-CSE/IT-2010( )

[A] pq + (1 - p) (1 - q) [B] (1 - q)p
[C] (1 - p)q [D] pq

64) What is the probability that divisor of 10^{99} is a multiple of 10^{96}?

2 Marks GATE-CSE/IT-2010( )

[A] 1 / 625 [B] 4 / 625
[C] 12 / 625 [D] 16 / 625

65) A fair dice is tossed two times. The probability that the second toss results in a value that is higher than the first toss is

2 Marks GATE-ECE/TCE-2011( )

[A] 2 / 36 [B] 2 / 6
[C] 5 / 12 [D] 1 / 2

66) Two dice are rolled once. The probability that the sum on the dice is neither 9 nor 11 is

2 Marks ( )

[A] 5 / 6 [B] 1 / 3
[C] 2 / 3 [D] 1 / 2

67) Let P(E) denotes the probability of the event E. Given P(A) = 1, P(B) = 1 / 2. The values of P(A / B) and P(B / A) respectively are

1 Marks ( )

[A] 1 / 4 , 1 / 2 [B] 1 / 2 , 1 / 4
[C] 1 / 2 , 1 [D] 1, 1 / 2

68) A speaks truth in 75% and in 80% of cases. In what percentage of cases are they likely to contradict each other narrating the same incident

2 Marks ( )

[A] 5% [B] 45%
[C] 35% [D] 15%

69) If 3 is the mean & 3 / 2 is the standard deviation of a binomial distribution, then the distribution is

2 Marks ( )

[A] $\left(\frac{3}{4}+\frac{1}{4}\right)^{12}$ [B] $\left(\frac{1}{2}+\frac{3}{2}\right)^{12}$
[C] $\left(\frac{4}{5}+\frac{1}{5}\right)^{60}$ [D] $\left(\frac{1}{5}+\frac{4}{5}\right)^{5}$

70) If a fair coin is tossed four times. What is the probability that two heads and two tails will result ?

1 Marks ( )

[A] 3/8 [B] 1/2
[C] 5/8 [D] 3/4

71) →The probability that a man who is 'x' years old will die in a year is P. Then amongst 'n' persons $A_1, A_2, \ldots A_n$ each 'x' years old now, the probability that A_1 will die in one year is

2 Marks ( )

[A] $1/n^2$ [B] $1-(1-P)^n$
[C] $1/n^2[1-(1-P)^n]$ [D] $1/n[1-(1-P)^n]$

72) A can solve 90% of the problems given in a book and B can solve 70%. What is the probability that at least one of them will solve a problem, selected at random from the book?

1 Marks ( )

[A] 0.16 [B] 0.63
[C] 0.97 [D] 0.20

73) If the probabilities that A and B will die within a year are p and q respectively, then the probability that only one of them will be alive at the end of the year is

1 Marks ( )

[A] pq [B] p(1 −q)
[C] q(1 −p) [D] p+q−2pq

74) How many positive integers less than 100 are divisible by either 7 or 11

1 Marks ( )

[A] 2 [B] 22
[C] 20 [D] 23

75) Let a set A has a 4 elements then P(A) denotes the powerset of the set A. Now cardinality of P(A) is

1 Marks ( )

[A] 16 [B] 81
[C] 256 [D] 1

76) Which of the following statements is true in a year ?

1 Marks ( )

[A] Among any group of 366 people there must be at least one with the same birthday
[B] Among any group of 366 people there must be at least two with the same birthday
[C] Among any group of 366 people there must be at most one with the same birthday
[D] Among any group of 366 people there must be at most none with the same birthday

77) What is the probability that a card selected from a deck is a king ?

1 Marks ( )

[A] 1/4 [B] 1/52
[C] 4/52 [D] 2/52

78) What is the probability that a positive integer less than 100 selected at random is divisible by 25 ?

2 Marks ( )

[A] 3 / 100 [B] 4 / 100
[C] 2 / 100 [D] 5 / 100

79) What is the probability that a positive integer selected at random from the set of positive integers not exceeding 21 is divisible by 5 or 3 ?

1 Marks ( )

[A] 11/20 [B] 10/20
[C] 11 / 21 [D] 10/21

80) X is uniformly distributed random variable that takes values between 0 and 1. The value of $E(x^3)$ will be

1 Marks ( )

[A] 1/4 [B] 0
[C] 1/8 [D] 1/2

81) In answering a question on multiple choice test, the students either knows the answer or guesses the answer. Let 'P' be the probability that student knows the answer and i– p that of guessing the answer. Assume that the student guess the answer to a question will be correct with a probability 1/5. What is the additional probability that the students knows the answer to a question given that he answered correctly.

1 Marks ( )

[A] $\frac{4P}{5P+1}$ [B] $\frac{5P}{4P+1}$
[C] $\frac{5P+1}{4}$ [D] $\frac{4P+1}{5}$

82) An unbalanced dice (with 6 faces, numbered from 1 to 6) is thrown. The probability that the face value is odd is 90% of the probability that the face value is even. The probability of getting any even numbered face is the same. If the probability that the face is even given that it is greater than 3 is 0.75, which one of the following options is closest to the probability that the face value exceeds 3 ?

2 Marks ( )

[A] 0.453 [B] 0.468
[C] 0.485 [D] 0.492

83) If 20 percent managers are technocrats, the probability that a random committee of 5 managers consists of exactly 2 technocrats is:

2 Marks GATE-ME-1993( )

[A] 0.2048 [B] 0.4000
[C] 0.4096 [D] 0.9421

84) The manufactunng area of a plat is divided into four quadrants. Four machines have to be located, one in each quandrant. The total number of possible layouts is

1 Marks GATE-ME-1995( )

[A] 4 [B] 8
[C] 16 [D] 24

85) A box contains 5 black balls and B red balls. A total of three balls are picked from the box one after another, without replacing them back. The probability of getting two black balls and one red ball is

2 Marks GATE-ME-1997( )

[A] 3/8 [B] 2/15
[C] 15/28 [D] 1/2

86) The probability of a defective piece being produced in a manufacturing process is 0.01. The probability that out of 5 successive pieces, only one is defective is

2 Marks GATE-ME-1996( )

[A] $(0.99)^4(0.01)$ [B] $(0.99)(0.01)^4$
[C] $5 \times (0.99)(0.01)^4$ [D] $5 \times (0.99)^4(0.01)$

87) The probability that two friends share the same birth-month is

1 Marks GATE-ME-1998( )

[A] 1/6 [B] 1/12
[C] 1/144 [D] 1/24

88) The probability that a student knows the correct answer to a multiple choice question is $\frac{2}{3}$. If the student does not know the answer, then the student guesses the answer. The probability of the guessed answer being correct is $\frac{1}{4}$ Given that the student has answered the question correctly, the conditional probability that the student knows the correct answer is

2 Marks GATE-ME-2013( )

[A] $\frac{2}{3}$ [B] $\frac{3}{4}$
[C] $\frac{5}{6}$ [D] $\frac{8}{9}$

89) In a manufacturing plant, the probability of making a defective bolt is 0.1. The mean and standard deviation of defective bolts in a total of 900 bolts are respectively

2 Marks GATE-ME-2000( )

[A] 90 and 9 [B] 9 and 90
[C] 81 and 9 [D] 9 and 81

Probability & Statistics

90) Suppose X is a normal random variable with mean 0 and variance 4. Then the mean of the absolute value of X is

2 Marks GATE-ME-1999,GATE-ME-1999( )

[A] $\frac{1}{\sqrt{2\pi}}$ [B] $\frac{2\sqrt{2}}{\sqrt{\pi}}$

[C] $\frac{2\sqrt{2}}{\sqrt{\pi}}$ [D] $\frac{2}{\sqrt{\pi}}$

91) Two dice are thrown. What is the probability that the sum of the numbers on the two dice is eight ?

1 Marks GATE-ME-2002( )

[A] 5/36 [B] 5/18

[C] 1/4 [D] 1/3

92) Manish has to travel from A to D changing buses at stops B and C enroute. The maximum waiting time at either stop can be 8 minutes each, but any time of waiting up to 8 minutes is equally likely at both places. He can afford up to 13 minutes of total waiting time, if he is to arrive at D on time. What is the probability that Manish will arrive late at D ?

2 Marks GATE-ME-2002( )

[A] 8/13 [B] 13/64

[C] 119/128 [D] 9/128

93) Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between successive arrivals. The length of a phone call is distributed exponentially with mean 3 minutes. The probability that an arrival does not have to wait before service is

2 Marks GATE-ME-2002( )

[A] 0.3 [B] 0.5

[C] 0.7 [D] 0.9

94) An unbiased coin is tossed three times. The probability that the head turns up in exactly two cases is

2 Marks GATE-ME-2001( )

[A] 1/9 [B] 1/8

[C] 2/3 [D] 3/8

95) The area enclosed between the parabola $y = x^2$ and the straight line $y = x$ is

2 Marks GATE-ME-2003( )

[A] 1/8 [B] 1/6

[C] 1/3 [D] 1/2

96) A box contains 5 black and 5 red balls. Two balls are.randomly picked one after another from the box, without replacement. The probability for both balls being red is

2 Marks GATE-ME-2003( )

[A] 1/90 [B] 1/5

[C] 19/90 [D] 2/9

97) A flexible rotor-shaft system comprises of a 10 kg rotor disc placed in the middle of a mass-less shaft of diameter 30 mm and length 500 mm between bearings (shaft is being taken mass-less as the equivalent mass of the shaft is included in the rotor mass) mounted at the ends. The bearings are assumed to simulate simply supported boundary conditions. the shaft is made of steel fo; which the value of E is 2.1 x 10^{11} Pa. What is the critical speed of rotation of the shaft ?

2 Marks GATE-ME-2003( )

[A] 60 Hz [B] 90 Hz

[C] 135 Hz [D] 180 Hz

98) The parabolic are $y = \sqrt{x}$, $1 \le x \le 2$ is revolved around the x-axis. The volume of the solid of revolution is

1 Marks GATE-ME-2010( )

[A] $\pi/4$ [B] $\pi/2$

[C] $3\pi/4$ [D] $3\pi/2$

99) 25 persons are in a room. 15 of them play hockey, 17 of them play football and 10 of them play both hockey and football. Then the number of persons playing neither hockey nor football is :

1 Marks GATE-ME-2010( )

[A] 2 [B] 17

[C] 13 [D] 3

100) Given digits 2, 2, 3, 3, 3, 4, 4, 4, 4 how many distinct 4 digit numbers greater than 3000 can be formed ?

2 Marks GATE-ME-2010( )

[A] 50 [B] 51
[C] 52 [D] 54

101) The area enclosed between the straight line $y = x$ and the parabola $y = x^2$ in the x-y plane is

1 Marks GATE-ME-2012( )

[A] 1/6 [B] 1/4
[C] 1/3 [D] 1/2

102) A box contains 4 red balls and 6 black balls. Three balls are selected randomly from the box one after another, without replacement. The probability that the selected set contains one red ball and two black balls is

2 Marks GATE-ME-2012( )

[A] 1/20 [B] 1/12
[C] 3/10 [D] 1/2

103) If three coins are tossed simultaneously, the probability of getting at least one head

1 Marks GATE-ME-2009( )

[A] 1/8 [B] 3/8
[C] 1/2 [D] 7/8

104) An unbiased coin is tossed five times. The outcome of each toss is either a head or a tail. The probability of getting at least one head is

2 Marks GATE-ME-2011( )

[A] 1/32 [B] 13/32
[C] 16/32 [D] 31/32

105) From a pack of regular playing cards, two cards are drawn at random. What is the probability that both cards will be Kings, if the first card is NOT replaced ?

2 Marks GATE-ME-2004( )

[A] 1/26 [B] 1/52
[C] 1/169 [D] 1/221

106) A lot has 10% defective items. Ten items are chosen randomly from this lot. The probability that exactly 2 of the chosen items are defective is

1 Marks GATE-ME-2005( )

[A] 0.0036 [B] 0.1937
[C] 0.2234 [D] 0.3874

107) A box contains 20 defective items and 80 non-defective items. If two items are selected at random without replacement, what will be the probability that both items are defective ?

1 Marks GATE-ME-2006( )

[A] 1/5 [B] 1/25
[C] 20/99 [D] 19/495

108) A single die is thrown twice. What is the probability that the sum is neither 8 nor 9?

2 Marks GATE-ME-2005( )

[A] 1/9 [B] 5/36
[C] 1/4 [D] 3/4

109) Consider a continuous random variable with probability density function
$f(t)=1+t$ for $-1 \le t \le 0$
The standard deviation of the random variable is

2 Marks GATE-ME-2006( )

[A] $\frac{1}{\sqrt{3}}$ [B] $\frac{1}{\sqrt{6}}$
[C] $\frac{1}{3}$ [D] $\frac{1}{6}$

110) A coin is tossed 4 times. What is the probability of getting heads exactly 3 times?

1 Marks GATE-ME-2008( )

[A] $\frac{1}{4}$ [B] $\frac{3}{8}$
[C] $\frac{1}{2}$ [D] $\frac{3}{4}$

111) Let X and Y be two independent random variables. Which one of the relations between expectation (E), variance (Var) and covariance (Cov) given below is FALSE ?

2 Marks GATE-ME-2007( )

[A] E(XY)= E(X)E(Y)
[B] Cov (X,Y) = 0
[C]Var (X+Y) = Var (X)+Var(Y)
[D]$E(X^2Y^2) = (E(X))^2(E(Y))^2$

112) Arrivals at a telephone booth are considered be Poisson with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially with a mean of 3 minutes. The probability that a person arriving at the booth will have to wait, is

2 Marks IES-ME-2000( )

[A]0.043
[B] 0.300
[C]0.429
[D]0.700

Statement for Linked answer Q113 and Q114 is given below

113) If A is a 3 x 3 matrix with entries from the set { - 1 , 0 , 1}
Then the total number of different matrices of order '3' , which are neither symmetric nor skew-symmetric is

2 Marks ( )

[A] $(3^3+1)(3^6+1)$
[B] $(3^3-1)(3^6-1)$
[C] $3^9-3^6-3^3-1$
[D] $3^9-3^6+3^3-1$

114) The probability that 'A' is neither symmetric nor skew symmetric is

2 Marks ( )

[A] $(1-3^{-6})(1-3^{-3})$
[B] $(1+3^{-6})(1-3^{-3})$
[C] $(1-3^{-6})(1+3^{-3})$
[D] $1+3^{-6})(1+3^{-3})$

Statement for Linked answer Q115 and Q116 is given below

115) Consider the experiment of tossing a pair of unbiased dice
The probability that the sum of the two numbers is a prime number is

2 Marks ( )

[A]7/9
[B] 5/12
[C]4/9
[D]7/12

116) If the experiment is repeated 180 times then how many times we can expect the sum to be a prime number

2 Marks ( )

[A]140
[B] 105
[C]80
[D]75

Statement for Linked answer Q117 and Q118 is given below

117) The probability of a man hitting a target is 1/4 .
If he fires 4 times , then the probability of his hitting the target at least twice is

2 Marks ( )

[A]189/256
[B] 196/256
[C]67/256
[D]64/256

118) The least number of times he must fire so that the probability of his hitting the target at least once is greater than 2/3 is

2 Marks ( )

[A] 3
[B] 4
[C]5
[D]6

Probability & Statistics

Key Paper

1.	D	2.	B	3.	A	4.	D	5.	A
6.	A	7.	A	8.	B	9.	C	10.	D
11.	C	12.	D	13.	B	14.	B	15.	C
16.	C	17.	D	18.	C	19.	D	20.	C
21.	D	22.	A	23.	C	24.	A	25.	C
26.	D	27.	B	28.	A	29.	B	30.	D
31.	D	32.	D	33.	A	34.	C	35.	D
36.	C	37.	D	38.	B	39.	B	40.	B
41.	C	42.	B	43.	C	44.	D	45.	C
46.	B	47.	C	48.	C	49.	C	50.	D
51.	B	52.	C	53.	C	54.	C	55.	A
56.	A	57.	C	58.	C	59.	C	60.	A
61.	D	62.	A	63.	A	64.	D	65.	C
66.	A	67.	D	68.	C	69.	A	70.	A
71.	D	72.	C	73.	D	74.	A	75.	A
76.	B	77.	C	78.	A	79.	D	80.	A
81.	B	82.	B	83.	A	84.	D	85.	C
86.	D	87.	B	88.	D	89.	A	90.	C
91.	A	92.	A	93.	A	94.	D	95.	C
96.	D	97.	B	98.	D	99.	D	100.	B
101.	A	102.	D	103.	D	104.	D	105.	D
106.	B	107.	D	108.	D	109.	B	110.	A
111.	D	112.	B	113.	B	114.	A	115.	B
116.	D	117.	C	118.	B				

Transforms

1) If X(Z) is the z-transform of $x[n] = \left(\frac{1}{2}\right)^{|n|}$ the ROC of X(z) is

2 Marks DRDO-ECE/TCE-2008( )

[A] |z|>2 [B] |z|<2

[C] $\frac{1}{2} < |z| < 2$ [D] the entire z-plane

2) The two sided Laplace transform of $x(t) = e^{-3t}u(t) + e^{2t}u(-t)$

2 Marks DRDO-ECE/TCE-2009( )

[A] $X(s) = \frac{-5}{s^2+s-6}, -3 < \sigma < 2$ [B] $X(s) = \frac{-5}{s^2+s-6}, -2 < \sigma < 3$

[C] $X(s) = \frac{-5}{s^2+s-6}, -3 < \sigma < -2$ [D] $X(s) = \frac{-5}{s^2+s-6}, -2 < \sigma < 3$

3) The z-transform X(z) of a sequence x[n] is given by

$$X(z) = \frac{z^{30}}{\left(z-\frac{1}{2}\right)(z-2)(z+3)}$$

If X(z) converges for |z|=1 then x[-18] is

2 Marks ( )

[A] $-\frac{1}{9}$ [B] $-\frac{2}{21}$

[C] $-\frac{1}{10}$ [D] $-\frac{2}{27}$

4) The z-transform X(z) of a real and right sided sequences x[n] has exactly two poles and one of them is at $z = e^{j\pi/2}$ and there are two zeroes at the origin . If X(1) =1 , which one of the following is TRUE?

2 Marks DRDO-ECE/TCE-2009( )

[A] $X(z) = \frac{2z^2}{(z-1)^2+2},\ ROC\ is \frac{1}{2} < |z| < 1$ [B] $X(z) = \frac{2z^2}{(z)^2+1},\ ROC\ is\ |z| > \frac{1}{2}$

[C] $X(z) = \frac{2z^2}{(z-1)^2+2},\ ROC\ is\ |z| > 1$ [D] $X(z) = \frac{2z^2}{(z)^2+1},\ ROC\ is\ |z| > 1$

5) The Fourier Transform of $e^{\alpha t}$ cos (αt) is equal to

2 Marks GATE-ECE/TCE-1997( )

[A] $\frac{(s-\alpha)}{(s-\alpha)^2+\alpha^2}$ [B] $\frac{(s+\alpha)}{(s-\alpha)^2+\alpha^2}$

[C] $\frac{1}{(s-\alpha)^2}$ [D] None of the above

6) The inverse Laplace transform of the $\frac{s+5}{(s+1)(s+3)}$ is

2 Marks GATE-ECE/TCE-1996( )

[A] $2e^{-t} - e^{-3t}$ [B] $2e^{-t} + e^{-3t}$

[C] $e^{-t} - 2e^{-3t}$ [D] $e^{-t} + e^{-3t}$

7) Which of the following Derichlets conditions are correct for convergence of Fourier transform of the function x(t)?

1. x(t) is square integrable
2. x(t) must be periodic
3. x(t) should have finite number of maxima and minima within any finite interval
4. x(t) should have finite number of discontinuities within any finite interval

1 Marks IES-ECE/TCE-2013( )

[A] 1, 2, 3 and 4 only [B] 1, 2 and 4 only

[C] 1, 3 and 4 only [D] 2, 3 and 4 only

8) If f(t) is a real and odd function, then its Fourier transform F(ω) will be

1 Marks IES-ECE/TCE-2013( )

[A] real and even function of ω [B] real and odd function of ω

[C] imaginary and odd function of ω [D] imaginary function of ω

9) For certain sequences which are neither absolutely summable nor square summable, it is possible to have a Fourier Transform (FT) representation if we

1 Marks IES-ECE/TCE-2013( )

[A] take short time FT [B] evaluate FT only the real part of the sequence

[C] allow DTFT to contain impulses [D] evaluate FT over a limited time span

10) A unit impulse function $\delta(t)$ is defined by

1. $\delta(t)$ = 0 for all t except t = 0
2. $\int_{-\infty}^{\infty} \delta(t)$ =1

The Fourier transform F(ω) of $\delta(t)$ is

1 Marks IES-ECE/TCE-2013( )

[A] 1 [B] 1 / ω
[C]0 [D] 1 / jω

11) if the z – transform of x(n) is x(z) = $\frac{z(8z-7)}{4z^2-7z+3}$, then the $\lim_{n\to\infty} x(n)$ is

1 Marks IES-ECE/TCE-2013( )

[A] 1 [B] 2
[C]∞ [D]0

12) For the discrete signal x[n] = a^nu[n] the z – transform is

1 Marks IES-ECE/TCE-2013( )

[A]z / z+a [B] z–a / z
[C]z / a [D]z / z–a

13) If the power spectral density is $\frac{\eta}{2}\frac{W}{Hz}$ and the auto correlation function is defined by $R(\tau) = \frac{\eta}{2}\int_{-\infty}^{\infty} e^{j\omega\tau}$ df
The integral on the right represents the Fourier transform of

1 Marks IES-ECE/TCE-2013( )

[A] Delta function [B] Step function
[C]Ramp function [D]Sinusoidal function

14) Laplace transform for the function f(x) = cosh(ax) is

2 Marks GATE-CE-2009( )

[A]$\frac{a}{s^2-a^2}$ [B]$\frac{s}{s^2-a^2}$
[C]$\frac{a}{s^2+a^2}$ [D]$\frac{s}{s^2+a^2}$

15) Transformation to linear form by substituting $v = y^{1-n}$ of the equation $\frac{dy}{dt} + p(t)y = q(t)y^n; n > 0$ will be

2 Marks GATE-CE-2005( )

[A]$\frac{dv}{dt} + (1-n)pv = (1-n)q$ [B]$\frac{dv}{dt} + (1-n)pv = (1+n)q$
[C]$\frac{dv}{dt} + (1+n)pv = (1-n)q$ [D]$\frac{dv}{dt} + (1+n)pv = (1+n)q$

16) If L defines the Laplace Transform of a function, L [sin (at)] will be equal to

2 Marks GATE-CE-2003( )

[A] $a/(s^2-a^2)$ [B]$a/(s^2+a^2)$
[C]$s/(s^2+a^2)$ [D] $s/(s^2-a^2)$

17) The Fourier series expansion of a symmetric and even function, f(x) where
$f(x) = 1 + (2X/\pi),\ -\pi < x < 0$
$= 1 - (2X/\pi),\ 0 < x < \pi$
will be

2 Marks GATE-CE-2003( )

[A] $\sum_{n=1}^{\infty}(4/\pi^2n^2)(1+cosn\pi)$ [B] $\sum_{n=1}^{\infty}(4/\pi^2n^2)(1-cosn\pi)$
[C]$\sum_{n=1}^{\infty}(4/\pi^2n^2)(1-sinn\pi)$ [D]$\sum_{n=1}^{\infty}(4/\pi^2n^2)(1+sinn\pi)$

18) List of the following series as x approaches $\frac{\pi}{2}$ is
$f(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!}$

1 Marks GATE-CE-2001( )

[A] $\frac{2\pi}{3}$ [B] $\frac{\pi}{2}$
[C]$\frac{\pi}{3}$ [D]1

19) The Laplace Transform of the following function is
$f(t) = \begin{cases} sint\ for\ 0 \le t \le \pi \\ 0\ for\ t > \pi \end{cases}$

Transforms

2 Marks GATE-CE-2002( )

[A] $\frac{1}{1+s^2}$ *for all* $s > 0$

[B] $\frac{1}{1+s^2}$ *for all* $s < \pi$

[C] $\frac{1+e^{-\pi s}}{1+s^2}$ *for all* $s > 0$

[D] $\frac{e^{-\pi s}}{1+s^2}$ *for all* $s > 0$

20) The inverse Laplace Transform of $\frac{1}{(s^2+2s)}$ is

2 Marks GATE-CE-2001( )

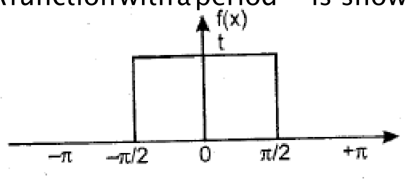
[A] $(1-e^{-2t})$

[B] $\frac{(1+e^{+2t})}{2}$

[C] $\frac{(1-e^{+2t})}{2}$

[D] $\frac{(1-e^{-2t})}{2}$

21) A function with a period 2π is shown below.



The Fourier series for this function is given by

1 Marks GATE-CE-2000( )

[A] $f(x) = \frac{1}{2} + \sum_{n=l}^{\infty} \frac{2}{n\pi} sin \frac{n\pi}{2}$

[B] $f(x) = \sum_{n=l}^{\infty} \frac{2}{n\pi} sin \frac{n\pi}{2} cos\ nx$

[C] $f(x) = \sum_{n=l}^{\infty} \frac{2}{n\pi} sin \frac{n\pi}{2}$

[D] $f(x) = \sum_{n=l}^{\infty} \frac{2}{n\pi} sin \frac{n\pi}{2} sin\ nx$

22) The Laplace transform of the function
f(t) = k, 0 < t < c
= 0, c < t < ∞ is

2 Marks GATE-CE-1999( )

[A] $\frac{k}{s} e^{-\infty}$

[B] $\frac{k}{s} e^{\infty}$

[C] ke^{∞}

[D] $\left(\frac{k}{s}\right)(1-e^{\infty})$

23) Let $\pounds F(s) = \pounds[If(t)]$ denote the Laplac transform of the function f(t). Which of the following statements is correct ?

2 Marks GATE-CE-2000( )

[A] $\pounds\left[\frac{\mathrm{d}f}{\mathrm{d}t}\right] = \frac{1}{s}F(s)$; $\pounds\int_0^t f(\tau)d\tau = sF(s) - f(o)$

[B] $\pounds\left[\frac{\mathrm{d}f}{\mathrm{d}t}\right] = sF(s) - F(0)$; $\pounds\left[\int_0^t f(\tau)d\tau\right] = -\frac{\mathrm{d}F}{\mathrm{d}s}$

[C] $\pounds\left[\frac{\mathrm{d}f}{\mathrm{d}t}\right] = sF(s) - F(0)$; $\pounds\left[\int_0^t f(\tau)d\tau\right] = F(s-a)$

[D] $\pounds\left[\frac{\mathrm{d}f}{\mathrm{d}t}\right] = sF(s) - F(0)$; $\pounds\left[\int_0^t f(\tau)d\tau\right] = \frac{1}{s}F(s)$

24) The Laplace Transform of a unit step function $u_o(t)$, defined as
$u_o(t) = \{0\ for\ 1 < a$
$= \{1\ for\ t > a$

1 Marks GATE-CE-1998( )

[A] $e^{-\alpha s}/s$

[B] $se^{-\alpha s}$

[C] $s - u(0)$

[D] $se^{-\alpha s} - 1$

25) If the unilateral Laplace transform X(s) of a signal x(t) is $\frac{7s+10}{s(s+2)}$, then the initial and final values of the signal would be respectively.

1 Marks IES-EEE-2000( )

[A] 3.5 and 5

[B] zero and 7

[C] 5 and zero

[D] 7 and 5

26) The Fourier transform of a signal $x(t) = e^{-4|t|}$ is

2 Marks ISRO-ECE/TCE-2010( )

[A] $8/(16+\omega^2)$

[B] $-8/(16-\omega^2)$

[C] $4/(16+\omega^2)$

[D] $-4/(16+\omega^2)$

27) The region of the z plane for which $\left|\frac{z-a}{z+a}\right| = 1(Re\ a \neq 0)$ is

2 Marks ISRO-ECE/TCE-2007( )

[A] x-axis

[B] y-axis

[C] The straight line z = | a|

[D] None of the above

Transforms

28) Laplace transform of $t^2 + 2t + 3$ is

2 Marks ISRO-ECE/TCE-2007( )

[A] $\frac{-2}{s^3} - \frac{2}{s^2} - \frac{3}{s}$
[B] $\frac{2}{s^3} + \frac{2}{s^2} - \frac{3}{s}$
[C] $\frac{2}{s^3} + \frac{2}{s^2} + \frac{3}{s}$
[D] $\frac{-2}{s^3} + \frac{2}{s^2} - \frac{3}{s}$

29) The constant term in the Fourier expansion of f(x) if f(x) = 2 + x , −2 < x < 0
= 2 – x , 0 < x < 2

1 Marks ( )

[A] 2
[B] – 2
[C] 1
[D] 1 / 2

30) If Fourier Transform of F(x) is f(s) then the Fourier Transform of F(x – a) is

1 Marks ( )

[A] $e^{ias} f(s)$
[B] $e^{-ias} f(s)$
[C] 1 / a f(s / a)
[D] 1 / a f(a / s)

31) The Fourier Series of f(x) if f(x) = 1 0 < x < π
= 0 π < x < 2π is

2 Marks ( )

[A] $\frac{1}{2} - \frac{2}{\pi} \sum_{n=1}^{\infty} \frac{sin\ nx}{n}$
[B] $\frac{1}{2} - \frac{4}{\pi} \sum_{n=1}^{\infty} \frac{sin\ nx}{n}$
[C] $\frac{1}{2} - \frac{2}{\pi} \sum_{n=1}^{\infty} \frac{cos\ nx}{n}$
[D] $\frac{1}{2} - \frac{4}{\pi} \sum_{n=1}^{\infty} \frac{cos\ nx}{n}$

32) The Laplace Transform of $\frac{sin\ ht}{t}$ is

2 Marks ( )

[A] $\frac{1}{2}\ log\ \left(\frac{S+1}{S-1}\right)$
[B] $\frac{1}{2}\ log\ \left(\frac{S-1}{S+1}\right)$
[C] $\frac{1}{4}\ log\ \left(\frac{S^2+1}{S^2-1}\right)$
[D] $\frac{1}{4}\ log\ \left(\frac{S^2-1}{S^2+1}\right)$

33) The Z-transform of $2^n.Sin(n\pi/2)$ is

2 Marks ( )

[A] $\frac{2z}{(4Z^2+1)}$
[B] $\frac{2z}{(Z^2+4)}$
[C] $\frac{2z}{(4Z^2-1)}$
[D] $\frac{2z}{(Z^2-4)}$

34) The Laplace Transform of t sint is

1 Marks ( )

[A] $\frac{-2s}{(s^2+1)^2}$
[B] $\frac{2s}{(s^2+1)^2}$
[C] $\frac{2s^2}{(s^2+1)^2}$
[D] $\frac{-2s^2}{(s^2+1)^2}$

35) Z-Transform of $n.z^n$ is ....

1 Marks ( )

[A] $\frac{2z}{(z-2)^2}$
[B] $\frac{2z}{(2z-1)^2}$
[C] $\frac{4z}{(z-2)^2}$
[D] $\frac{z}{(2z-1)^2}$

36) The half range cosine series of f(x) = x in the interval (0,2) is given by $f(x) = \frac{a_0}{2} + \sum a_n\ cos\ \left(\frac{n\pi x}{2}\right)$ then $a_{1=}$

2 Marks ( )

[A] 0
[B] $\frac{-2}{\pi^2}$
[C] $\frac{4}{\pi^2}$
[D] $\frac{-8}{\pi^2}$

37) The Inverse Laplace Transform of $\frac{1}{(s+2)^2}$ is ....

2 Marks ( )

[A] $t^2 e^{-2t}$
[B] te^{-2t}
[C] te^{2t}
[D] (e^{-2t}/t)

38) $Z^{-1}\left\{\frac{z}{(z+1)^2}\right\} = \ldots\ldots\ldots$

2 Marks ( )

[A] $(-1)^n n^2$
[B] $(-1)^n\ n$
[C] $(-1)^{n-1}\ n$
[D] $(-1)^{n-1}\ n^2$

39) If F{ f(x) } = g(s) then F { f(x−1) } = ...

2 Marks ( )

[A] $e^{-is}g(s)$
[B] $e^{is}g(s)$
[C] $-e^{is}g(s)$
[D] $-e^{-is}g(s)$

40) $L^{-1}\left\{\frac{e^{-as}}{s^2}\right\} = \ldots\ldots\ldots$

2 Marks ( )

[A] (t – a) H(t – a)
[B] $(t-a)\ \delta(t-a)$
[C] $(t-a)^2\ H(t-a)$
[D] $(t-a)^2\ \delta(t-a)$

41) The Fourier series of the periodic function $f(x) = x + x^2, -\pi < x \leq \pi$ at x = π converges to

1 Marks ( )

[A] π
[B] 2π
[C] π^2
[D] $\pi + \pi^2$

42) $L^{-1}\left\{\frac{1}{s}\left(\frac{s-1}{s+1}\right)\right\} =$

1 Marks ( )

[A] $2e^t - 1$
[B] $2e^{-t} - 1$
[C] $1 + 2e^{-t}$
[D] $1 - 2e^{-t}$

43) If the Fourier transform of f(x) = F(s) then the Fourier transform of f(x) cos ax is

1 Marks ( )

[A] $\frac{1}{2}[F(s+a) + F(s-a)]$
[B] $\frac{1}{2}[f(s+a) - F(s-a)]$
[C] $\frac{1}{4}[f(s-a) - F(s+a)]$
[D] $\frac{1}{4}[F(s+a) - F(s-a)]$

44) If $F(t) = \begin{cases} t, & 0 < t < 1 \\ 1, & 1 < t \end{cases}$ Then L { F(t) }=

2 Marks ( )

[A] $\frac{1+e^{-s}}{s^2}$
[B] $\frac{1-e^{-s}}{s^2}$
[C] $\frac{1+e^{s}}{s^2}$
[D] $\frac{1-e^{s}}{s^2}$

45) If $f(x) = \left(1 - \left(\frac{x}{\pi}\right)\right)^2$ then the Fourier cosine transform of f(x) in (0, π) is

2 Marks ( )

[A] $\frac{2}{\pi n^2}$
[B] $\frac{2n^2}{\pi}$
[C] $\frac{\pi}{2n^2}$
[D] $\frac{\pi n^2}{2}$

46) The Z-transform of $\frac{1}{(n+1)(n+2)}$ is

2 Marks ( )

[A] $(z^2 - z)\ log\left(1 - \frac{1}{z}\right) + z$
[B] $(z^2 - z)\ log\left(z - \frac{1}{z}\right) - z$
[C] $(z^2 - z)\ log\left(1 + \frac{1}{z}\right) + z$
[D] $(z^2 - z)\ log\left(1 + \frac{1}{z}\right) - z$

47) In what range should Re(s) remain so that the Laplace transform of the function $e^{(a+2)t+5}$ exits.

2 Marks GATE-ECE/TCE-2005( )

[A] Re (s) >a+2
[B] Re (s) >a+7
[C] Re (s) <2
[D] Re (s) >a + 5

48) For the equation $x''(t) + 3x'(t) + 2x(t) = 5$, the solution x (t) approaches which of the following values at t → ∞?

2 Marks GATE-EEE-2005( )

[A] 0
[B] 5/2
[C] 5
[D] 10

Transforms

49) The differential equation dx/dt = (1−x)/τ is discretised using Euler's numerical integration method with a time step Δ T > 0. What is the maximum permissible value of Δ T to ensure stability of the solution of the corresponding discrete time equation?

2 Marks GATE-EEE-2007( )

[A] 1 [B] τ/2

[C] τ [D] 2 τ

50) The bisection method is applied to compute a zero of the function f(x) = $x^4 - x^3 - x^2 - 4$ in the interval [1,9]. The method converges to a solution after________ iterations.

2 Marks GATE-CSE/IT-2012( )

[A] 1 [B] 3

[C] 5 [D] 7

51) If $f(t) = \frac{\omega}{S^2+\omega^2}$, then the value of $\lim_{\to\infty} f(t)$

2 Marks GATE-ECE/TCE-1998( )

[A] Cannot be dertedrmined [B] is zero

[C] is unity [D] is infinite

52) The trigonometric Fourier series of a periodic time function can have only

2 Marks GATE-ECE/TCE-1998( )

[A] cosine terms [B] sine terms

[C] cosine and sine terms [D] d.c. and cosine terms

53) The following $e^{-3t}(2\ cos\ 5t - 3\ sin\ 5t)$ of Laplace transform is

1 Marks ( )

[A] $\frac{2s-9}{s^2+6s+34}$ [B] $\frac{s}{s^2+6s+34}$

[C] $\frac{1}{s^3+6s+34}$ [D] $\frac{s^2}{s^3+6s+34}$

54) F.S.T of $\frac{1}{x}$

1 Marks ( )

[A] $\sqrt{\frac{2}{\pi}}$ [B] $\sqrt{\frac{\pi}{2}}$

[C] $\frac{\pi}{2}$ [D] $\frac{2}{\pi}$

55) If $Z\{u_n\} = \frac{z^2-3z+4}{(z-3)^3}$ for $|z| < 3$, then u_3 is

2 Marks ( )

[A] 1 [B] 0

[C] 3 [D] 2

56) If $u_n = 2^n$; n < 0
$= 3^n$; $n \geq 0$, then ROC is

1 Marks ( )

[A] $2 < |z| < 3$ [B] $|z| > 0$

[C] $|z| \geq 3$ [D] Does not exist

57) Apply the transform to $L\{t\ J_1(t)\}$ is

1 Marks ( )

[A] $\frac{5}{(s^2+1)^{3/2}}$ [B] $\frac{1}{(s^2+1)^{3/2}}$

[C] $\frac{s}{(s^2+1)^{3/2}}$ [D] $\frac{1}{(s^2+2)^{3/2}}$

58) if $\int_0^\infty f(x) sin\ tx\ dx = \begin{cases} 1 & ; 0 \leq t \leq 1 \\ 2 & ; 1 \leq t \leq 2 \\ 0 & ; t \geq 2 \end{cases}$ then find f(x)?

2 Marks ( )

[A] $\frac{2}{\pi}\left[\frac{-cosx}{x} + \frac{1}{x} - \frac{2cos2x}{x} - \frac{2cosx}{x}\right]$ [B] $\frac{2}{\pi}\left[\frac{-cosx}{x} + \frac{1}{x} - \frac{2cos2x}{x} + \frac{2cosx}{x}\right]$

[C] $\frac{2}{\pi}\left[\frac{1}{x} - \frac{2cos2x}{x} - \frac{3cosx}{x}\right]$ [D] $\frac{2}{\pi}\left[\frac{-cosx}{x} + \frac{1}{x} + \frac{2cos2x}{x} + \frac{2cosx}{x}\right]$

Transforms

59) What is answer of this equation $\int_0^\infty t\ e^{-3t}\ sint\ dt$ is

1 Marks ( )

[A]$\frac{1}{50}$
[B]$\frac{3}{60}$
[C]$\frac{3}{50}$
[D]$\frac{2}{25}$

60)$z^{-1}\left[\frac{z}{(z-1)^2}\right]$ is_____

2 Marks ( )

[A]u(n)
[B]$n^2 u(n)$
[C]nu(n)
[D]$n^{-2} u(n)$

61) Solve the following function $L\frac{1}{t}\delta(t-a)$

2 Marks ( )

[A]$\frac{1}{a}e^{-as}$
[B]$\frac{1}{as}e^{-as}$
[C]$\frac{s}{a}e^{-as}$
[D]$\frac{2s}{a}e^{-as}$

62)$a^n * a^n$= _____

1 Marks ( )

[A](n+1)u(n)
[B]$a^n(n+1)u(n)$
[C]$a^n u(n)$
[D]u(n)

63)$\int_0^\infty \frac{x^2}{(x^2+a^2)^2}dx = ?$

2 Marks ( )

[A]$\frac{\pi}{2}$
[B]$\frac{\pi}{a}$
[C]$\frac{\pi}{2a}$
[D]$\frac{\pi}{4a}$

64) What is inverse Fourier transform of $\frac{s+2}{s^2-4s+13}$ is

2 Marks ( )

[A]$e^{2t}\ cos\ 3t + \frac{4}{3}\ e^{2t}\ sin\ 3t$
[B]$e^{2t}\ sin\ 3t + \frac{4}{3}\ e^{2t}\ cos\ 3t$
[C]$e^{2t}\ sin\ 2t + \frac{4}{3}\ e^{2t}\ cos\ 3t$
[D]$e^{2t}\ cos\ 2t + \frac{4}{3}\ e^{2t}\ sin\ 2t$

65) The voltage across an impedance in a network is V (s) = z (s) I (s) , where V(s) , Z(s) are the Laplace transforms of the corresponding time function v (t) , z (t) and i (t). The voltage v (t) is:

2 Marks GATE-ME-1991( )

[A]$V(t) = Z(t).V(t)$
[B]$V(t) = \int_0^1 i(t).z(t-\tau)d\tau$
[C]$V(t) = \int_0^1 i(t).z(t+\tau)d\tau$
[D]$V(t) = z(t) + i(t)$

66)$(s+1)^{-2}$is the Laplace transform of

1 Marks GATE-ME-1998( )

[A]t^2
[B]t^3
[C]e^{-2t}
[D]te^{-t}

67) Laplace transform of $(a+bt)^2$ where 'a' and 'b' are constants is given by

1 Marks GATE-ME-1999( )

[A]$(a+bs)^2$
[B]$\frac{1}{(a+bs)^2}$
[C]$\frac{a^2}{s}+\frac{2ab}{s^2}+\frac{2b^2}{s^3}$
[D]$\frac{a^2}{s}+\frac{2ab}{s^2}+\frac{b^2}{s^3}$

68) The Laplace transform of the function $sin^2 2t$, is

2 Marks GATE-ME-2000( )

[A]$\left[\frac{1}{2s}-\frac{s}{2(s^2+16)}\right]$
[B] $\frac{s}{s^2+16}$
[C]$\frac{1}{s}-\frac{s}{(s^2+4)}$
[D] $\frac{s}{s^2+4}$

69) Laplace transform of the function sin t is

2 Marks GATE-ME-2003( )

[A]$\frac{s}{s^2+\omega^2}$
[B]$\frac{\omega}{s^2+\omega^2}$
[C]$\frac{s}{s^2-\omega^2}$
[D]$\frac{\omega}{s^2-\omega^2}$

70) The Laplace transform of a function f(t) is $\frac{1}{s^2(s+1)}$. The function f(t) is

2 Marks GATE-ME-2010( )

[A] t - 1 + e^{-t} [B] t + 1 + e^{-t}
[C] -1 + e^{-t} [D] 2t + e^{t}

71) The inverse Laplace transform of the function $F(s) = \frac{1}{s(s+1)}$ is given by

2 Marks GATE-ME-2012( )

[A] f(t) = sin t [B] f(t) = e^{-t} sin t
[C] f(t) = e^{-t} [D] f(t) 1 - e^{-t}

72) The inverse Laplace transform of $\frac{1}{(s^2 + s)}$ is

1 Marks GATE-ME-2009( )

[A] 1 + e^{t} [B] 1 - e^{t}
[C] 1 - e^{-t} [D] 1 + e^{-t}

73) A delayed unit step function is defined as

$u(t-a) = \begin{cases} 0 \text{ for } t < a \\ 1 \text{ for } t \geq a \end{cases}$.

Its Laplace transform is

2 Marks GATE-ME-2004( )

[A] $a.e^{-as}$ [B] $\frac{e^{-as}}{s}$
[C] $\frac{e^{as}}{s}$ [D] $\frac{e^{as}}{a}$

74) Eigenvalues of a matrix $S = \begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix}$ are 5 and 1. What are the eigenvalues of the matrix S^2 = SS?

2 Marks GATE-ME-2006( )

[A] 1 and 25 [B] 6 and 4
[C] 5 and 1 [D] 2 and 10

75) If F(s) is the Laplace transform of function f(t), then Laplace transform of $\int_0^t f(\tau)d\tau$ is

2 Marks GATE-ME-2007( )

[A] 1/s F(s) [B] 1/s F(s) - f(0)
[C] sF(s) - f(0) [D] $\int F(s)ds$

76) Given $f(t) = L^{-1}\left[\frac{3s+1}{s^3+4s^2+(k-3)s}\right]$ If $\lim_{t\to\infty} f(t) = 1$ then value of "K" is

2 Marks ( )

[A] 4 [B] 2
[C] 3 [D] 1

77) If $x[n] = (1/3)^{|n|} - (1/2)^n u[n]$, then the region of convergence (ROC) of its Z-transform in the Z-plane will be

1 Marks GATE-ECE/TCE-2012,GATE-EEE-2012( )

[A] $\frac{1}{3} < |z| < 3$ [B] $\frac{1}{3} < |z| < \frac{1}{2}$
[C] $\frac{1}{2} < |z| < 3$ [D] $\frac{1}{3} < |z|$

Transforms

Key Paper

1.	**C**	**2.**	**A**	**3.**	**B**	**4.**	**D**	**5.**	**A**
6.	**A**	**7.**	**C**	**8.**	**C**	**9.**	**C**	**10.**	**A**
11.	**A**	**12.**	**D**	**13.**	**A**	**14.**	**B**	**15.**	**A**
16.	**B**	**17.**	**B**	**18.**	**D**	**19.**	**C**	**20.**	**D**
21.	**A**	**22.**	**D**	**23.**	**D**	**24.**	**A**	**25.**	**D**
26.	**A**	**27.**	**B**	**28.**	**C**	**29.**	**C**	**30.**	**B**
31.	**A**	**32.**	**A**	**33.**	**B**	**34.**	**B**	**35.**	**A**
36.	**D**	**37.**	**B**	**38.**	**C**	**39.**	**A**	**40.**	**A**
41.	**D**	**42.**	**B**	**43.**	**A**	**44.**	**B**	**45.**	**A**
46.	**A**	**47.**	**A**	**48.**	**B**	**49.**	**D**	**50.**	**B**
51.	**A**	**52.**	**D**	**53.**	**A**	**54.**	**B**	**55.**	**B**
56.	**D**	**57.**	**B**	**58.**	**B**	**59.**	**C**	**60.**	**C**
61.	**A**	**62.**	**B**	**63.**	**D**	**64.**	**A**	**65.**	**A**
66.	**D**	**67.**	**C**	**68.**	**A**	**69.**	**B**	**70.**	**A**
71.	**D**	**72.**	**C**	**73.**	**B**	**74.**	**A**	**75.**	**A**
76.	**A**	**77.**	**C**						