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 New Delhi-110062
Supplementary/Improvement Exam-2024
For Odd Semester-2023

Paper Name: Mathematical Foundation of Computer Science
 Total Marks: 60

Paper Code: BCA/B.Sc.-103
 Total Time: 2.5 hrs.

Attempt all questions from section A, any Four questions from section B and any Two questions from section C.

Abbreviations Used

CO-Course Outcomes:

- CO1: Students will become skilled in computations and applications of matrices to solve industrial problems.
 CO2: Represent vectors, compute dot and cross products for presentations of lines and planes.
 CO3: Determine and understand the concept of gradient, curl, divergence, conic section, and curvature.
 CO4: Solve applied problems using differentiation and Partial differentiation.
 CO5: Solve problems using mathematics in unfamiliar settings.

[SECTION-A]

All questions are compulsory. True or False & Fill in the blanks.

[20 Marks]

Q. No.	Questions	Marks	CO	BL
1.	True/False; If A and B are invertible 3×3 matrices, then $(AB)^{-1} = B^{-1}A^{-1}$.	1	CO1	L2
2.	True/False; Every square matrix satisfies its own characteristic equation.	1	CO2	L1
3.	True/False; Eigen value of null matrix is zero.	1	CO3	L3
4.	True/False; The Dot product of two-unit vectors is always unity.	1	CO4	L2
5.	True/False; The Cross product of two-unit vectors is always a unit vector.	1	CO5	L1
6.	True/False; If Two vectors are parallel then their Cross product is Zero.	1	CO2	L2
7.	True/False; The eccentricity of Ellipse is greater than one.	1	CO4	L3
8.	True/False; The constant function is only even function.	1	CO2	L2
9.	True/False; If f is continuous at any point, then it is also differentiable at that point.	1	CO3	L2
10.	True/False; The degree of Non-linear differential equation is one.	1	CO4	L1
11.	An asymptote is a.....that approaches closer to a given curve.	1	CO1	L4
12.	If an asymptote is neither parallel to x-axis nor to y-axis then it is called? a): Oblique b): Vertical c): Horizontal d): None	1	CO2	L3
13.	If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 4 \\ 3 & 6 \end{bmatrix}$, then find $A \times B$.	1	CO3	L1
14.	If $A = \begin{bmatrix} 4 & 5 \\ 2 & 3 \end{bmatrix}$, find $A + A^T$.	1	CO2	L2
15.	If λ is the eigen value of A then Find the eigen value of A^{-1} .	1	CO1	L3
16.	The equation of circle whose centre is (h, k) and radius is r is given by?	1	CO4	L4
17.	Y – intercept is the point where the parabola crosses a): X – axis b): Y – axis c): both axis d): None.	1	CO5	L2
18.	The trace of a matrix is the sum of all the elements on its.....	1	CO3	L2
19.	The n^{th} derivative of e^{ax} is $y_n = \dots e^{ax}$. (a): a^n (b): a^{n-1} (c): e^a (d): None	1	CO4	L1
20.	The Curl represents the.....of a vector field around a point in 3D space.	1	CO2	L1

SECTION-B

Attempt any Four questions.

4 × 05 = 20 Marks

Q. No.	Questions	Marks	CO	BL
1.	If $A = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 8 \\ 7 & 9 \end{bmatrix}$, then verify that $(AB)^{-1} = B^{-1}A^{-1}$.	5	CO1	L3
2.	If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, Express $2A^5 - 3A^4 + A^2 - 4I$ as a linear polynomial in A.	5	CO2	L4
3.	Find $\text{div } \vec{F}$ and $\text{curl } \vec{F}$, at the point (1,2,3) for $\vec{F} = x^2 yz i + xy^2 z j + xyz^2 k$.	5	CO3	L5
4.	Find the proper values of the matrix, $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$.	5	CO1	L2
5.	Find the centre and radius of the circle $3x^2 + 3y^2 - 8x - 10y + 3 = 0$.	5	CO4	L6
6.	Find the eccentricity, the foci and the latus rectum of the ellipse $2x^2 + 5y^2 = 20$.	5	CO5	L4

SECTION-C

Attempt any Two questions.

2 × 10 = 20 Marks

Q. No.	Questions	Marks	CO	BL
1.	(a): Find the Rank of the matrix by rank method not by Echelon form. $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$ (b): Using Cayley-Hamilton theorem, find A^8 , if $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$.	5 5	CO1	L1,L2
2.	(a): If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then show that $\nabla r^n = n r^{n-2} \vec{r}$. (b): Prove that $f(x, y) = x^3 - 2x^2y + 3xy^2 + y^3$ is homogeneous, what is the degree? Verify Euler's Theorem for f .	5 5	CO3	L2,L4
3.	If $y = \log(1 + \cos x)$ then prove that $y_1 y_2 + y_3 = 0$.	10	CO4	L5
4.	(a): Using matrix method show that the system of equations $x + y + z = 6$, $x + 2y + 3z = 14$, $-x + y - z = -2$, are consistent and hence obtain the solutions for x, y, z . (b): If $z = \log(x^2 + y^2)$, show that $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = 0$.	5 5	CO2	L4,L5

BL- Bloom's Taxonomy Levels: (1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating)