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Odd Semester Examination-2022

Paper Name: Mathematical Foundation of Computer Science **Paper Code:** BCA/B.Sc.-103
Total Marks: 60 **Total Time:** 3 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.

BL-Bloom's Taxonomy Levels:

(**1**-Remembering, **2**-Understanding, **3**-Applying, **4**-Analysing, **5**-Evaluating, **6**-Creating)

[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 $A = \begin{bmatrix} 0 & -5 & 8 \\ 5 & 0 & 12 \\ -8 & -12 & 0 \end{bmatrix}$, then matrix is symmetric matrix.	1	CO1	L4
2.	**True/False;** If A and B are invertible 2×2 matrices, then $(AB)^{-1} = A^{-1}B^{-1}$	1	CO1	L1

3.	**True/False;** If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 4 \end{bmatrix}$, then matrix is skew- symmetric matrix.	1	CO1	L2
4.	**True/False;** $(I - A)(I - B) = Zero\ matrix$. If A^2 is Involutory matrix and I is Identity matrix.	1	CO1	L1
5.	**True/False;** A linear system of four equations in three unknowns is always consistent.	1	CO1	L1
6.	**True/False;** A function is differentiable when there is cusp or a corner point in its graph.	1	CO1	L1
7.	**True/False;** The magnitude of curl is related to the speed of rotation.	1	CO3	L1
8.	**True/False;** If $A = [a_{ij}]$ is a scalar matrix then trace of A is given by $\sum\sum a_{ij}$.	1	CO1	L2
9.	**True/False;** The resultant product of two odd functions is odd.	1	CO2	L2
10.	**True/False;** If f is continuous at the number x, then it may be differentiable at x.	1	CO3	L1
11.	If $A\acute{A} = I$ then the matrix is.................	1	CO4	L1
12.	If $A = \begin{bmatrix} -1 & 4 \\ 5 & 8 \end{bmatrix}$ then trace of matrix A is.................	1	CO4	L2
13.	If A is any $m \times n$ matrix such that AB and BA are both defined. Then the order of matrix B..............	1	CO3	L1
14.	The process of finding partial derivative is known as.............	1	CO5	L2
15.	The rate at which the tangent line or velocity vector is turning is called..................	1	CO3	L2
16.	The gradient is a scalar quantity and produces a ....quantity.	1	CO4	L1
17.	Singular matrices have.............Eigen values.	1	CO5	L1

18.	The product of the eigen values of matrix A is equal to the ....of A.	1	CO2	L2
19.	The div $\vec{V}$ gives the rate of outflow per unit..........at a point of the fluid.	1	CO3	L2
20.	n^{th} differential coefficient of a^x is given by $y_n = \log a \times \ldots\ldots\ldots$	1	CO4	L4

SECTION-B

Attempt any Four questions. **4 × 05 = 20 Marks**

Q. No.	Questions	Marks	CO	BL
1.	Express the matrix $A = \begin{bmatrix} -1 & 7 & 1 \\ 2 & 3 & 4 \\ 5 & 0 & 5 \end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix.	5	CO1	L2
2.	Determine the values of x, y, z when $\begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ y & -y & z \end{bmatrix}$ is orthogonal.	5	CO3	L3
3.	Find $\frac{dy}{dx}$, when $x = 2cost - cos2t,\ y = 2sint - sin2t\ at\ t = \frac{\pi}{4}$.	5	CO4	L4
4.	If $Z = f(x, y)$ is homogeneous function of x and y of degree n, then show that $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = nz$.	5	CO5	L5
5.	Find the sine angle between the vectors $3\hat{\imath} + \hat{\jmath} + 2\hat{k}$ and $2\hat{\imath} - 2\hat{\jmath} + \widehat{4k}$.	5	CO5	L6
6.	Differentiate the function w.r.t. x. $\frac{e^x + e^{-x}}{e^x - e^{-x}}$.	5	CO2	L1

SECTION-C

Attempt any Two questions. **2 × 10 = 20 Marks**

Q. No.	Questions	Marks	CO	BL
1.	**(a):** Find the Eigen values of the matrix, where. $$A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}.$$ **(b):** Verify Cayley-Hamilton theorem and find the inverse of matrix $$A = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}.$$	5 5	CO1	L2
2.	Find the divergence and curl of the vector $\vec{V} = (xyz)\hat{\imath} + (3x^2y)\hat{\jmath} + (xz^2 - y^2z)\hat{k}$ at the point (2, -1, 1).	10	CO2	L3
3.	What do you mean by Asymptotes, Points of inflexion and Rank of Matrix? Find the Rank of the matrix A = $\begin{bmatrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 10 & 3 & 9 & 7 \\ 16 & 4 & 12 & 15 \end{bmatrix}$.	10	CO3	L4
4.	For what values of λ the system of equations, $x + 2y - 3z = 1,\ 2x - \lambda y - 3z = 2,\ x + 2y + \lambda z = 3$ has unique solution. Find the solution for $\lambda = 0$.	10	CO1	L5