Total Pages: 02 Roll No.....

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Odd Semester Exam-2024

Paper Name: Mathematical Foundation of Computer Science **Paper Code:** BCA-103
Total Marks: 60 **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 $A = \begin{bmatrix} a & h & g \\ -h & b & f \\ -g & -f & c \end{bmatrix}$, Then matrix is symmetric matrix.	1	CO2	L1
2.	True/False; In a square matrix if two rows/column are proportional, then the value of its determinant is zero.	1	CO1	L2
3.	True/False; The determinant of a Non-Singular matrix is zero.	1	CO3	L3
4.	True/False; A dependent system has infinitely many solutions.	1	CO1	L1
5.	True/False; The eigen value λ for matrix A and A^T is not same.	1	CO2	L2
6.	True/False; The Cayley Hamilton theorem allows A^n to be expressed as a linear combination of the lower matrix powers of A.	1	CO3	L1
7.	True/False; The rank of an identity matrix is not equal to its order.	1	CO4	L3
8.	True/False; The gradient measures the direction of greatest change in a scalar field.	1	CO1	L1
9.	True/False; The divergence measures how much something is expanding out from a point.	1	CO3	L3
10.	True/False; The curl measures how much something is swirling around in a circle.	1	CO4	L2
11.	The curvature of a straight line is	1	CO5	L3
12.	The point where the function changes its concavity is called.....	1	CO3	L2
13.	A two-dimensional shape that is round and has no straight edges or corners is called.....	1	CO4	L3
14.	The point is a circle whose diameter is.....	1	CO3	L1
15.	The equation of a straight line is (a): linear (b): Non-linear (c): both (d): None.	1	CO4	L4
16.	Two lines are parallel if their slopes are.....	1	CO5	L3
17.	If $m_1 m_2 = -1$ then two lines are said to be.....	1	CO4	L2
18.	The trace of a matrix is the sum of all the elements on its.....	1	CO2	L1
19.	A sphere is .....in all directions. (a): asymmetrical (b): symmetrical (c): both (d): None.	1	CO5	L2
20.	If $\Delta \neq 0$, $h = 0$ and $a = b$, then it represents the.....	1	CO4	L1

SECTION-B

Attempt any Four questions. 4 × 05 = 20 Marks

Q. No.	Questions	Marks	CO	BL
1.	If $x+y=\begin{vmatrix}2 & 5\\ 2 & 1\end{vmatrix}$ and $x-y=\begin{vmatrix}4 & 3\\ 2 & 5\end{vmatrix}$, then find x and y.	5	CO1	L3
2.	Reduce the matrix A to a diagonal form if $A=\begin{bmatrix}-1 & 2 & -2\\ 1 & 2 & 1\\ -1 & -1 & 2\end{bmatrix}$ also find the rank of A.	5	CO2	L4
3.	If $x^y = e^{x-y}$ then prove that $\frac{dy}{dx}=\frac{logx}{(1+logx)^2}$.	5	CO4	L5
4.	Prove that $f(x,y)=x^3-2x^2y+3xy^2+y^3$ is homogeneous, what is the degree of the function ? Verify Euler's Theorem for f.	5	CO5	L2
5.	For what value of λ the given equation $\lambda x^2-10xy+12y^2+5x-16y-3=0$ represents a pair of straight lines?	5	CO4	L6
6.	Find the volume of a sphere whose surface area is 154 cm^2. Also find the total surface area of the hemisphere.	5	CO5	L4

SECTION-C

Attempt any Two questions. 2 × 10 = 20 Marks

Q. No.	Questions	Marks	CO	BL
1.	Find the characteristic equation of the matrix $A=\begin{bmatrix}1 & 3 & 7\\ 4 & 2 & 3\\ 1 & 2 & 1\end{bmatrix}$, show that the equation is satisfied by A and hence obtain the inverse of the given matrix.	10	CO1	L1, L2
2.	(a): If $\vec{F}=(x+y+1)\hat{\imath}+\hat{\jmath}-(x+y)\hat{k}$, then show that $\vec{F}$.Curl $\vec{F}=0$. (b): If $u=x^2y+y^2z+z^2x$, show that $u_x+u_y+u_z=(x+y+z)^2$	5 5	CO3	L2, L4
3.	If $y=log(1+cosx)$ then prove that $y_1y_2+y_3=0$.	10	CO4	L5
4.	(a): Find the radius of curvature for $f(x)=3x^2+3x-2$ at $x=1$. (b): Solve the differential equation $(1+x^2)\frac{dy}{dx}+2xy-4x^2=0$, subject to the initial condition $y(0)=0$.	5 5	CO2	L3, L6

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