LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **COMPUTER SCIENCE**

FOURTH SEMESTER – **APRIL 2023**

UMT 4406 – MATHEMATICS FOR COMPUTER SCIENCE

Date: 04-05-2023 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

	SECTION A - K1 (CO1)
	Answer ALL the Questions (10 x 1 = 10)
1.	**Answer the following**
a)	Give the order of the matrix $A = \begin{pmatrix} 1 & 2 & 0 \\ 2 & -4 & 0 \end{pmatrix}$.
b)	When does a function f said to be continuous at a point x_0?
c)	Define solenoidal vector.
d)	What is an ordinary differential equation?
e)	Write short notes on complete integral.
2.	**Fill in the blanks**
a)	Every square matrix satisfies its own ____________.
b)	The value of $\int x^3 dx$ is ____________.
c)	If F is conservative, then ____________.
d)	Second order linear ODE with variable coefficients is also known as ____________.
e)	The order of the PDE $\frac{\partial^2 y}{\partial x^2} - 3\frac{\partial y}{\partial x} - 10y = x^2$ is ____________.
	SECTION A - K2 (CO1)
	Answer ALL the Questions (10 x 1 = 10)
3.	**Choose the correct option**
a)	A square matrix $A = (a_{ij})$ is said to be a symmetric matrix if (i) $a_{ij} = a_{ii}$ (ii) $a_{ij} = a_{jj}$ (iii) $a_{ij} = a_{ji}$ (iv) $a_{jj} = a_{ii}$
b)	If $y = \sin 2x$, then $\frac{dy}{dx}$ is (i) $-2\sin 2x$ (ii) $2\sin 2x$ (iii) $-2\cos 2x$ (iv) $2\cos 2x$
c)	In the direction of the vector $2\vec{i} + 2\vec{j} - \vec{k}$, the directional derivative of $\Phi = x + xy^2 + yz^3$ at (0,1,1) is (i) 2 (ii) 3 (iii) 5 (iv) 1
d)	The degree of the differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$ is (i) 1 (ii) 2 (iii) 3 (iv) 4
e)	The solution of $z = px + qy + pq$ is (i) $z = p + q + pq$ (ii) $z = ax + by + pb$ (iii) $z = pa + qb + ab$ (iv) $z = cx + dy + cd$
4.	**Say True or False**
a)	A unit matrix is a diagonal matrix.
b)	One of the applications of integration is finding area.
c)	If F is a vector field, then $\nabla \cdot F$ is a vector field.

d)	The complementary function and general solution are different for $(D^2 - 2mD + m^2)y = 0$.
e)	In the equation $z = x^2 + y^2$, z is a dependent variable.
SECTION B - K3 (CO2)	
	Answer any TWO of the following (2 x 10 = 20)
5.	Determine $\int_0^5 \int_0^1 (x+y)dxdy$ and $\int_0^a \int_0^b (x^2+y^2)dxdy$.
6.	Verify Stroke's theorem for $A = (2x-y)\vec{i} - yz^2\vec{j} - y^2z\vec{k}$ taken over the upper half surface of the sphere $x^2+y^2+z^2 = 1$ and the boundary curve C, is the $x^2+y^2 = 1, z = 0$.
7.	Find the solution of the equation $(D^2+4D+5)y = e^x + x^3$.
8.	Solve the equation $pq + p + q = 0$.
SECTION C – K4 (CO3)	
	Answer any TWO of the following (2 x 10 = 20)
9.	Find the eigen vectors of the matrix $A = \begin{pmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & 1 \end{pmatrix}$.
10.	Using Bernoulli's formula determine $\int x^4 \sin x\, dx$.
11.	Determine the solution of the equation $3x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = x$.
12.	Solve the following partial differential equations a) $p = y^2q^2$ b) $p(1+q^2) = q(z-1)$.
SECTION D – K5 (CO4)	
	Answer any ONE of the following (1 x 20 = 20)
13.	a) Determine the characteristic equation of the matrix $A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$. Hence find its inverse. b) Find the maxima and minima of the function $y = x^3 - 18x^2 + 96x + 4$.
14.	Verify divergence theorem for $F = (x^3 - yz)\vec{i} - 2x^2\vec{j} + 2\vec{k}$ taken over the cube bounded by $x = 0, x = a, y = 0, y = a, z = 0$ and $z = a$.
SECTION E – K6 (CO5)	
	Answer any ONE of the following (1 x 20 = 20)
15.	Diagonalize the matrix $A = \begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$.
16.	a) Construct a Cauchy-Euler equation given $(5+2x)^2\frac{d^2y}{dx^2} - 6(5+2x)\frac{dy}{dx} + 8y = 6x$ and hence solve. b) Find the general solution of $x^2p + y^2q = (x+y)z$. (12+8)

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