PRN:		Course Code :	U01BS101

First Year **B. Tech** End Semester Examination Winter 2024

Applied Mathematics I

000074

Day and Date: Sat 13 0 NOV 2024

Max Marks: **50**

Time : 02:00PM To 04:00PM

Duration: **02** hrs

Instructions:

1. Use of non-programmable calculator is allowed.
2. Assume suitable data wherever necessary and mention it clearly.

		Marks	Bloom's Level	CO
Q.1	**Attempt the following Question.**			
a)	The rank of the matrix $A=\begin{bmatrix}1&2&3\\4&5&6\\7&8&9\end{bmatrix}$ is A. 3 B. 2 C. 1 D. 0	1	2	CO1
b)	The system of linear equation $2x-5y=4, 7x-y=2$ has A. no solution B. non-trivial solution C. unique solution D. trivial solution	1	1	CO1
c)	If $A=\begin{bmatrix}2&5&9\\0&-1&3\\0&0&7\end{bmatrix}$ then eigen values of A^3 are A. $2,-1,7$ B. $6,-3,21$ C. $8,1,343$ D. $8,-1,343$	1	2	CO2
d)	If the eigen values of A are $-1,0,5$ then the matrix A is A. Singular matrix B. Non-singular C. Zero matrix D. Identity matrix	1	3	CO2
e)	$x+\frac{x^3}{3}+\frac{2x^5}{15}+\ldots$ is the expansion of A. $\tan^{-1}x$ B. $\sin x$ C. $\tan x$ D. $\log(1-x)$	1	3	CO3
f)	$x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\frac{x^5}{5}-\ldots$ is the expansion of A. $\tan^{-1}x$ B. $\sin x$ C. $\tan x$ D. $\log(1+x)$	1	3	CO3

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g) If $u = x^y$ then $\frac{\partial u}{\partial y} =$ | 1 | 4 | CO4

A. yx^{y-1} B. $x^y \log y$ C. $x^y \log x$ D. $x^{y-1} \log y$

h) If $u = x^2y - y^3$ then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$ | 1 | 4 | CO4

A. $3(x^2y + y^3)$ B. $6(x^2y - y^3)$ C. $3(x^2y - y^3)$ D. $6(x^2y + y^3)$

i) The approximate value of the function $f(x+dx, y+dy) =$ | 1 | 1 | CO4

A. $f(x,y) - df$ B. $f(x,y) + df$

C. $df - f(x,y)$ D. $df + f(x,y)$

j) If $f = x^2 + y^2 + z^2$ then the relative error in x, y, z respectively are | 1 | 1 | CO4

A. dx, dy, dz B. $\frac{dx}{x}, \frac{dy}{y}, \frac{dz}{z}$

C. $100 \cdot \frac{dx}{x}, 100 \cdot \frac{dy}{y}, 100 \cdot \frac{dz}{z}$ D. dx, dy, dz

Q.2 Attempt any two of the following Question.

a) Find the rank of the following matrix by using normal form | 5 | 3 | CO1

$$\begin{bmatrix} 3 & 2 & 1 & 4 \\ -1 & 3 & 2 & 2 \\ 2 & 5 & 3 & 6 \\ 5 & 7 & 4 & 10 \end{bmatrix}$$

b) Test for consistency & if possible solve the equations, | 5 | 4 | CO1

$x + 2y - z = 1$; $3x - 2y + 2z = 2$; $7x - 2y + 3z = 5$.

c) Solve $x + 2y + 3z = 0$; $2x + 3y + z = 0$; $4x + 5y + 4z = 0$; $x + 2y - 2z = 0$ | 5 | 4 | CO1

Q.3 Attempt any two of the following Question.

a) Examine for linear dependence or independence. If dependent then find relation between them $(1,1,3,1), (2,2,7,-1), (3,-1,2,4)$ | 5 | 3 | CO2

b) Find the Eigen values and also find Eigen vector for the smallest Eigen value, where $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ | 5 | 3 | CO2

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c)	Verify Cayley Hamilton's theorem for $A=\begin{bmatrix}1 & 2 & -2\\ -1 & 3 & 0\\ 0 & -2 & 1\end{bmatrix}$	5	4	CO2

Q.4 Attempt any two of the following Question.

a)	Expand $\log(1+e^x)$ using Maclaurin's series	5	3	CO3
b)	Prove that $\log(x+h)=\log h+\frac{x}{h}-\frac{x^2}{2h^2}+\frac{x^3}{3h^3}-\ldots$	5	3	CO3
c)	Find the extreme values of $x^3+y^3-3axy,\ a>0$.	5	4	CO4

Q.5 Attempt any two of the following Question.

a)	If $u=\log\left(\frac{x^2+y^2}{x-y}\right)$ then find i) $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ ii) $x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}$	5	3	CO4
b)	If $x=v^2+w^2, y=u^2+w^2, z=u^2+v^2$ then find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$	5	4	CO4
c)	The resistance R of a circuit was found by using the formula $I=\frac{E}{R}$. If there is an error of 0.1 Amperes in reading I and 0.5 volts in E. Find the corresponding possible percentage error in R, when readings are $I=15$ *Amperes* and $E=100$ *volts*.	5	3	CO4

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