PRN:		Course Code :	U01BS101

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

Applied Mathematics I

Day and Date: 03/06/2024, Mon Max Marks: **50**

Time : 10:00AM To 12:30PM Duration: **02** hrs

Instructions:
1. All questions are compulsory.
2. Assume suitable data wherever necessary and mention it clearly.
3. Use of non-programmable calculator is allowed.

Q.1	**Attempt the following Question.**	**Marks**	**Bloom's Level**	**CO**
a)	If for a system of equations $AX = 0$ rank of A is less than number of unknowns then system has A. no solution B. non-trivial solution C. unique solution D. trivial solution	1	1	CO1
b)	The system of linear equation $x-2y=4, 4x-8y=3$ has A. no solution B. non-trivial solution C. unique solution D. trivial solution	1	2	CO1
c)	If the eigen values of A are $1,-1,5$ then eigen values of A^3 are A. $1,-1.25$ B. $1,-1,125$ C. $1,1.25$ D. $1,1,125$	1	2	CO2
d)	If the eigen values of A are $0,5,9$ then the matrix A is A. Singular matrix B. Non-singular C. Zero matrix D. Identity matrix	1	1	CO2
e)	If $y=\log(2x-1)$ then $y_n =$ A. $\frac{(-1)^{n-1}2^n n!}{(2x-1)^n}$ B. $\frac{(-1)^n 2^n n!}{(2x-1)^{n+1}}$ C. $\frac{(-1)^{n-1}2^n (n-1)!}{(2x-1)^n}$ D. $\frac{(-1)^{n-1}2^{n-1}(n-1)!}{(2x-1)^n}$	1	3	CO3
f)	If $y=\cos x \sin x$ then $y_n =$ A. $2^n \sin\left(2x+\frac{n\pi}{2}\right)$ B. $2^{n-1}\sin(2x)$ C. $2^{n-1}\cos\left(2x+\frac{n\pi}{2}\right)$ D. $2^{n-1}\sin\left(2x+\frac{n\pi}{2}\right)$	1	4	CO3

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g) $x+\frac{x^3}{3}+\frac{2x^5}{15}+\ldots$ is the expansion of — 1 | 1 | CO4

A. $\tan^{-1}x$ B. $\sin x$
C. $\tan x$ D. $\log(1-x)$

h) $-x-\frac{x^2}{2}-\frac{x^3}{3}-\frac{x^4}{4}-\frac{x^5}{5}-\ldots$ is the expansion of — 1 | 3 | CO4

A. $\tan^{-1}x$ B. $\sin x$
C. $\tan x$ D. $\log(1-x)$

i) If $u=x^y$ then $\frac{\partial u}{\partial y}=$ — 1 | 3 | CO4

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

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

A. $\frac{\partial x}{x},\frac{\partial y}{y},\frac{\partial z}{z}$ 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 | 2 | CO1

$$\begin{bmatrix}2&3&-1&-1\\1&-1&-2&-4\\3&1&3&-2\\6&3&0&-7\end{bmatrix}.$$

b) Test for consistency and if possible solve the equations given below — 5 | 4 | CO1

$6x+y+z=-4;\quad 2x-3y-z=0;\quad x+7y+2z=-7.$

c) Find the Eigen values and Eigen vectors of the matrix — 5 | 2 | CO2

$$\begin{bmatrix}1&0&-1\\1&2&1\\2&2&3\end{bmatrix}.$$

Q.3 Attempt any two of the following Question.

a) Find n^{th} derivative of $y=\frac{2}{(x-1)(x-2)(x-3)}$. — 5 | 3 | CO3

b) Find n^{th} derivative of $y=\cos x\cos(2x)\cos(3x)$. — 5 | 3 | CO3

c) If $y=\cos\left(m\sin^{-1}x\right)$, then prove that — 5 | 3 | CO3

$\left(1-x^2\right)y_{n+2}-(2n+1)xy_{n+1}+\left(m^2-n^2\right)y_n=0.$

Q.4 Attempt any two of the following Question.

a) Obtain the Maclaurian's expansion of $\tan\left(\frac{\pi}{4}+x\right)$. — 5 | 3 | CO4

b)	Using Taylor's theorem express $x^4-3x^3+2x^2-x+1$ in powers of $(x-3)$.	5	3	CO4
c)	Evaluate $\lim_{x\to 0}\frac{e^x-1-x}{\log(1+x)-x}$	5	2	CO4

.5 **Attempt any two of the following Question.**

a)	If $u=\sin\left(x^2-y^2\right)+\sin\left(y^2-z^2\right)+\sin\left(z^2-x^2\right)$, then prove that $\frac{1}{x}\frac{\partial u}{\partial x}+\frac{1}{y}\frac{\partial u}{\partial y}+\frac{1}{z}\frac{\partial u}{\partial z}=0$.	5	3	CO4
b)	Prove that $JJ'=1$ for $x=uv,\ y=\frac{u}{v}$.	5	4	CO4
c)	Evaluate $\int_0^1\frac{x^a-1}{\log x}dx\quad(a>0)$.	5	3	CO4

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