Roll No. ______________________

SIVS-N 194 A-18
B.A./B.Sc. IVth Semester Degree Examination
MATHEMATICS
(Linear Algebra and Laplace Transformation)
Paper : 4.1
(New)

Time : 3 Hours | Maximum Marks : 60

Instructions to Candidates:

*Answer **all** sections.*

SECTION - A

Answer any **TEN** of the following : **(10×2=20)**

1. Define vector space.
2. Define the linear combination of vector space over the field F.
3. Define the terms linearly dependent and Independent of a Vector space.
4. Prove that if S = $\{(1,0,0,0)\ (0,1,0,0), (0,0,1,0), (0,0,0,1)\}$ forms a basis of $V_4(R)$ and what is the dimension?
5. Define a vector - subspace.
6. Define the linear - Transformation of two vector spaces defined over the same field.
7. Find the Laplace transformation of $\left\{\sin t, \cos t, e^{at}\right\}$.
8. Find the Laplace transformation of $(1+e^t)^2$.
9. State convolution theorem.
10. Find the Inverse Laplace transform of $\left\{\frac{2s^2+5s-8}{s^3}\right\}$.

11. Find the Laplace transforms of $\{\sinh at + t^3 + e^{-3t}\}$.

12. Define Laplace transformation.

SECTION - B

Answer any **FOUR** of the following. **(4×5=20)**

1. Express $\begin{bmatrix} 2 & 1 \\ 1 & -1 \end{bmatrix}$ as a linear combination of $\left\{\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}, \begin{bmatrix} 0 & 2 \\ 0 & -1 \end{bmatrix}\right\}$.

2. Prove that any subset of linearly independent set is linearly independent

3. Define the terms Basis & Dimension Determine Whether

   $S = \{(1,0,0),(1\ 1\ 0),(1,1,1),(0,1,0)\}$ is a basis of $V_3(R)$ OR not?

4. Prove that the following is a α T $T: V_2(R) \to V_2(R)$ defined by $T(x,y) = (x\cos\theta - y\sin\theta, x\sin\theta + y\cos\theta)$.

5. Find the range, null spaces ; $s(T), v(T)$ & verify Rank. Nullity Theorem of LT $T: R^3 \to R^3$ defined by $T(e_1) = e_1 - e_2; T(e_2) = 2e_1 + e_3$ $T(e_3) = e_1 + e_2 + e_3$ Where $e_1 = (1\ 0\ 0), e_2 = (0\ 1\ 0), e_3 = (0,0,1)$.

6. Find the matrix of LT $T: R^2 \to R^2$ defined by $T(x,y) = (3x - 4y, x + 5y)$ Relative to the Basis

   i) $\{(1,0),(0,1)\}$

   ii) $\{(1,3),(2,5)\}$

SECTION - C

Answer any **FOUR** of the following. **(4×5=20)**

1. If $L\{f(t)\} = F(S)$ then prove the following

   i) $L\{f'(t)\} = SF(S) - f(0)$

   ii) $L\{f''(t)\} = S^2F(S) - Sf(0) - f'(0)$

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2. Find the Inverse Laplace Transform of $\{2S / S^2 + S - 2\}$.

3. Express $f(t)=\begin{cases} t & 0 < t \leq 2 \\ t^2 & t > 2 \end{cases}$ as unit step function & find Laplace transform.

4. Find the Inverse Laplace Transform of $\left\{\frac{s}{(s-3)(s^2+4)}\right\}$.

5. Solve $y'' - 9y = -8e^t$ Given $y(0) = 0$; $y'(0) = 10$.

6. Solve $y'' + y = 0$ Given $y(0) = 1$; $y'(0) = -1$
