3. a) Reduce the matrix $\begin{bmatrix} 1 & 1 & -1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix}$ to the normal form and find its rank.

b) Find the non trivial solution of the system x + 3y – 2z = 0, 2x – y + 4z = 0, x – 11y + 14z = 0.

c) Using Cayley-Hamilton theorem, find the inverse of the matrix $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$.

PART – C

Answer **two full** questions. **(2×15=30)**

4. a) Find n^{th} derivative of $\frac{x}{2x^2 + 3x + 1}$.

b) Find n^{th} derivative of cos5x cos3x.

c) If $y = \cos(m\cos^{-1}x)$ prove that $(1 - x^2)\, y_{n+2} - (2n + 1)\, xy_{n+1} - (n^2 - m^2)\, y_n = 0$.

OR

5. a) If z = sin (ax + y) + cos (ax – y) prove that $\frac{\partial^2 z}{\partial x^2} = a^2 \frac{\partial^2 z}{\partial y^2}$.

b) If $u = \cos^{-1}\left(\frac{x^3 + y^3}{x + y}\right)$ prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = -2\cot u$.

c) If $z = 4x - y^2$ where $x = uv^2$ and $y = u^3 v$ find $\frac{\partial z}{\partial u}$ and $\frac{\partial z}{\partial v}$.

6. a) State and prove the Euler's theorem on Homogeneous functions.

b) If u = 2xy and $v = x^2 - y^2$ and $x = r\cos\theta$, $y = r\sin\theta$ prove that $\frac{\partial(u,v)}{\partial(r,\theta)} = -4r^3$.

c) Evaluate $\int_0^{\pi} x \sin^4 x \cos^2 x\, dx$.

OR