Q. Let I be the purchase value of an equipment and $V(t)$ be the value after it has been used for t years. The value $\mathrm{V(t)}$ depreciates at a rate given by differential equation $\frac{\mathrm{dV(t)}}{\mathrm{dt}} = -\mathrm{k(T-t)}$ where $\mathrm{k} > 0$ is a constant and $\mathrm{T}$ is the total life in years of the equipment. Then the scrap value $\mathrm{V(T)}$ of the equipment is :-. (1) $\mathrm{I} - \frac{\mathrm{k(T-t)^2}}{2}$ (2) $\mathrm{e^{-kT}}$ (3) $\mathrm{T^2} - \frac{\mathrm{I}}{\mathrm{k}}$ (4) $\mathrm{I} - \frac{\mathrm{kT^2}}{2}$ [AIEEE-2011]

1 **JEE Main 2021 (Online) 27th August Evening Shift**

MCQ (Single Correct Answer)

If the solution curve of the differential equation $(2x - 10y^3)dy + ydx = 0$, passes through the points (0, 1) and (2, $\beta$), then $\beta$ is a root of the equation :

A $y^5 - 2y - 2 = 0$

B $2y^5 - 2y - 1 = 0$

C $2y^5 - y^2 - 2 = 0$

D $y^5 - y^2 - 1 = 0$

## Explanation

$(2x - 10y^3)dy + ydx = 0$

$\Rightarrow \frac{dx}{dy} + \left(\frac{2}{y}\right)x = 10y^2$

$I.F. = e^{\int \frac{2}{y}dy} = e^{2\ln(y)} = y^2$

Solution of D.E. is

$\therefore x\,.\,y = \int (10y^2)y^2.\,dy$

$xy^2 = \frac{10y^5}{5} + C \Rightarrow xy^2 = 2y^5 + C$

It passes through (0, 1) $\rightarrow$ 0 = 2 + C $\Rightarrow$ C = $-2$

Now, it passes through (2, $\beta$)

$2\beta^2 = 2\beta^5 - 2 \Rightarrow \beta^5 - \beta^2 - 1 = 0$

$\therefore \beta$ is root of an equation $y^5 - y^2 - 1 = 0$