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Exp 1 - ME 310

A-1 Simple Code in MATLAB (Already shown)

A-2 m = Last digit of roll + 1

$= 8 + 1 = 9\,Kg$

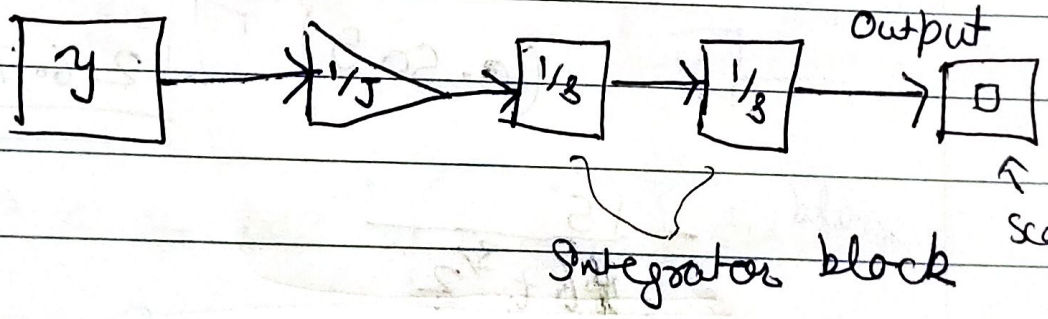
$r = 0.7$

$\Rightarrow J = \frac{mr^2}{2} = \frac{9 \times 0.7^2}{2} \cong 2.2$

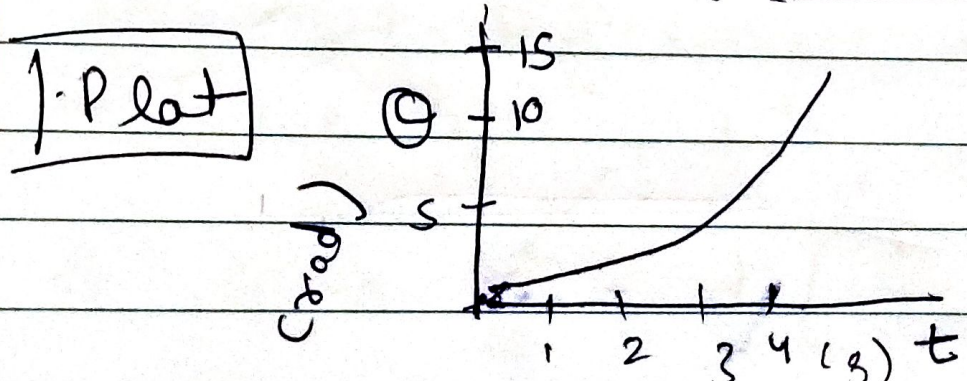
Eq^n $\Rightarrow \tau = J\alpha$

$\Rightarrow \boxed{\tau = J\ddot{\theta}}$

A-3 Block diagram

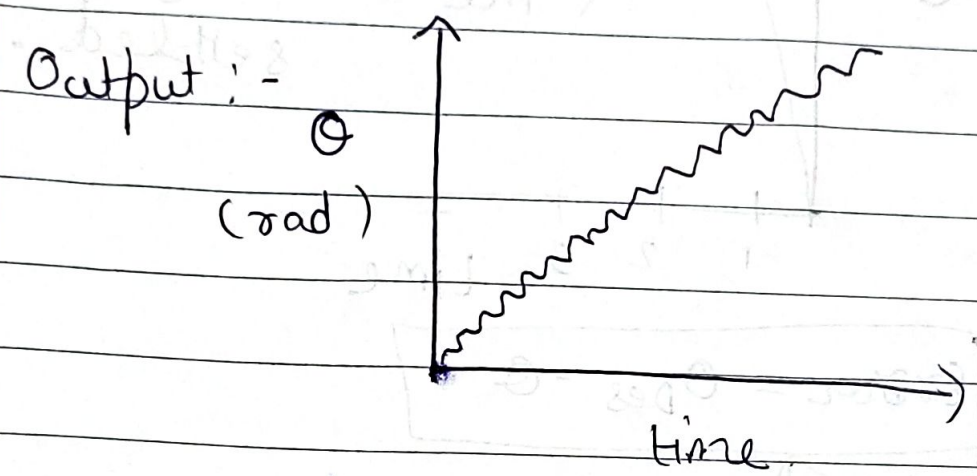


A-4 Put τ as step input @ in above block diagram using sources library



A-5 $y = A\sin(\omega t)$ where ω = sum of digit
and $A = 0.1$ $= 27$

- Again same block diagram, just replace y with this input.



⇒ Linear curve imposed with Sine curve.
⇒ After 2π rotation, it will repeat itself.
⇒ From above graph, it can be interpreted that linear rotation of curve is superimposed by sine curve with a particular frequency impacting it.

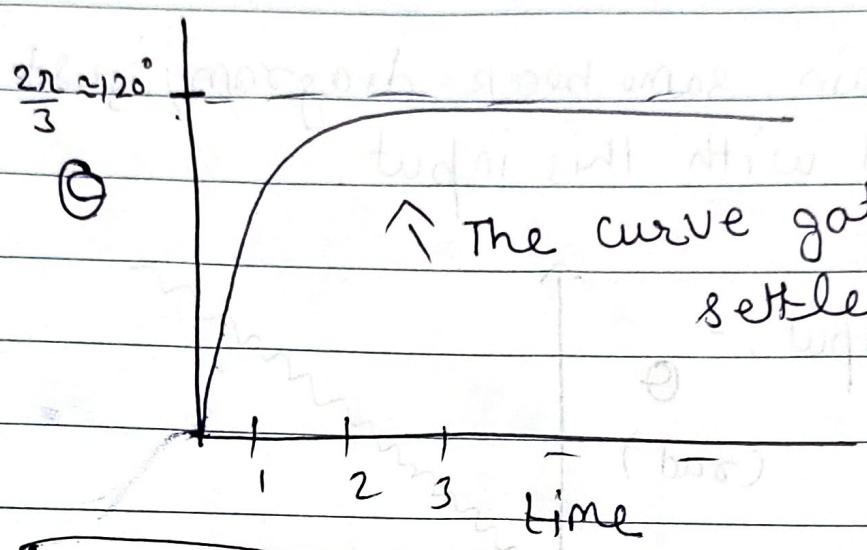
A-6 Eq^n of Torque used :- where $\theta_{des} = 120°$

$$\boxed{y = J\ddot{\theta} = K_p(\theta_{des} - \theta) - K_d\dot{\theta}}$$

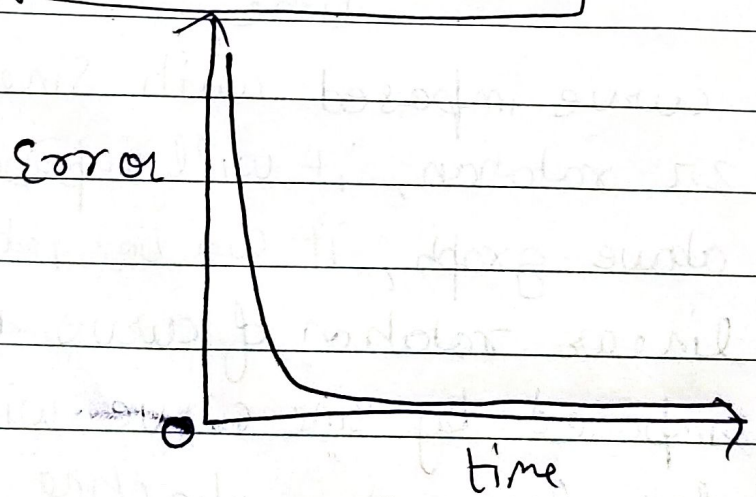
Ans 7

- For value of $\frac{K_p}{J} = 100$ & $\frac{K_D}{J} = 20$

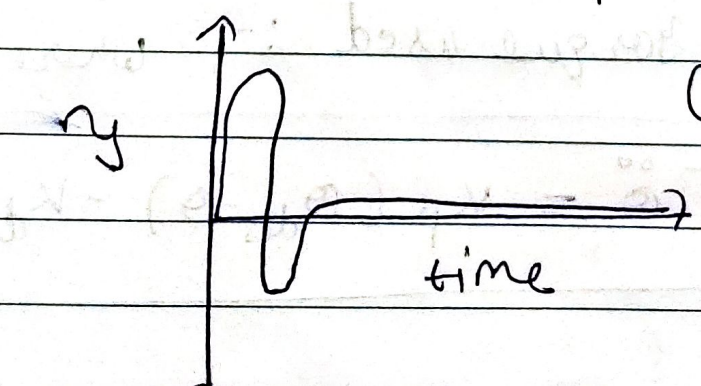
We got the plot



⇒ Error = $\Theta_{Des} - \Theta$



⇒ Torque curve = $K_p(\Theta_{Des} - \Theta) - K_D\dot{\Theta}$



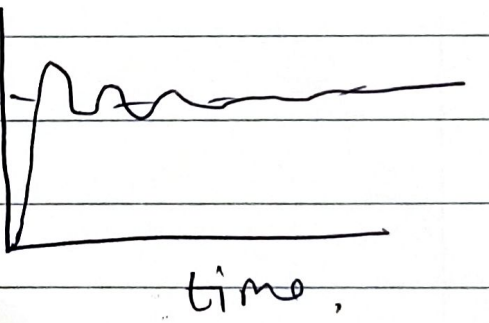
(Rough Sketch)

⇒ Error is decreasing for chosen value of K_p & K_D and approaches to zero.

⇒ Yes, Torque is zero when θ approaches θ_{des}.

A-8 For different values of K_p & K_D

Like K_p very large & K_D small, we got a oscillating curve with overshoot (like this)



⇒ But for $\frac{K_p}{J} = 100$ & $\frac{K_D}{J} = 20$, we got no oscilation and linear like system.