Homework#1

(a) Create a Simulink block diagram to simulate the response of a brush DC motor described by

\[
\frac{d\omega(t)}{dt} = -100\omega(t) + 1000v(t)
\]

where \( \omega \) (rad/s) is the angular velocity and \( v(t) \) (V) is the voltage applied. Simulate the response for 0.2 s, applying a step of voltage of 10 V at \( t = 0.1 \) s. Plot the speed as a function of time.

(b) Augment the previous Simulink block diagram with a proportional integral controller

\[
v(t) = k_P (\omega_{REF}(t) - \omega(t)) + k_I \int (\omega_{REF}(\tau) - \omega(\tau)) \, d\tau
\]

Let \( k_P = 0.02 \) and \( k_I = 4 \). Simulate the response for 0.5 s, applying a step of reference velocity of 100 rad/s at \( t = 0.1 \) s and another step of 200 rad/s at \( t = 0.3 \) s. Plot the speed and the voltage as functions of time.

In your report, be sure to label the axes of your plots, and to use line widths and font sizes that provide good readability. Also include a picture of your final Simulink diagram and of any sub-blocks or embedded m-files.