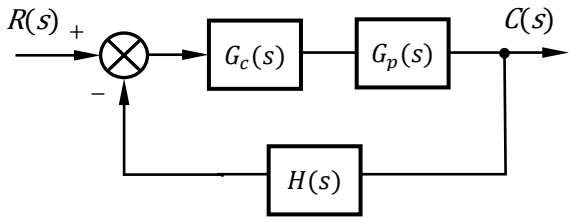
BILGI UNIVERSITY
Faculty of Engineering and Natural Sciences
Department of Electrical and Electronics Department

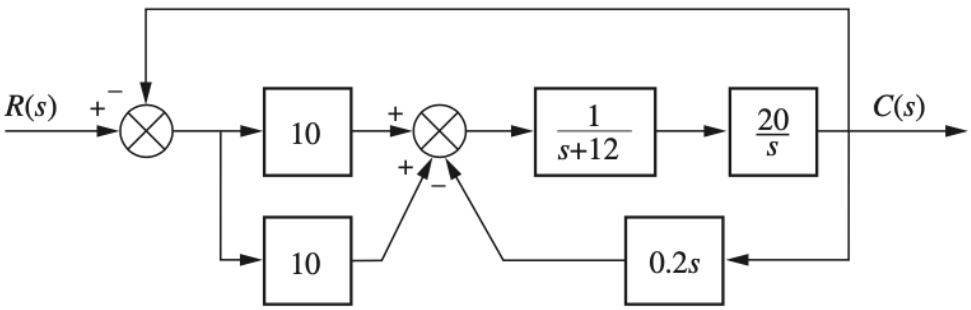
Course: EEEN 352 System Dynamics and Control
Instructors: Prof. Dr. Mehmet Nur Alpaslan Parlakçı & Prof. Dr. Şeref Naci Engin
Exam / Date: Quiz-2 / 30.04.2020, 12:00 – 12:45, **Duration:** 45 min. **Signature:**
Student Name: **Student Number:**

Problem 1. For the control system given, where the controller is $G_c(s) = K$ and the plant, i.e., the system to be controlled is $G_p(s) = \frac{1}{(s+2)(s+5)(s+10)}$ and the feedback sensor is $H(s) = 10$.

(a) Write the range of gain *K* making the system stable.
(b) Write the value of gain *K* making the system marginally stable.
(c) What would be the frequency of oscillation in Hz when the system is marginally stable?



Problem 2. For the system given find the equivalent single block that represents the transfer function, $T(s) = C(s)/R(s)$. Evaluate the settling time of the step response using the related formulae given at the footnote.



$T_p = \frac{\pi}{\omega_n\sqrt{1-\zeta^2}}$, $T_s \cong \frac{4}{\zeta\omega_n}$, $\%OS = 100.e^{-\zeta\pi/\sqrt{1-\zeta^2}}$, $\zeta = \frac{-\ln(\%OS/100)}{\sqrt{\pi^2+\ln^2(\%OS/100)}}$, $\lim_{t\to\infty} f(t) = \lim_{s\to 0} sF(s)$, *Good luck!*