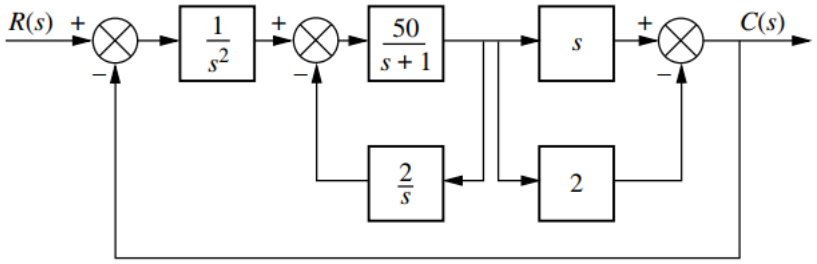
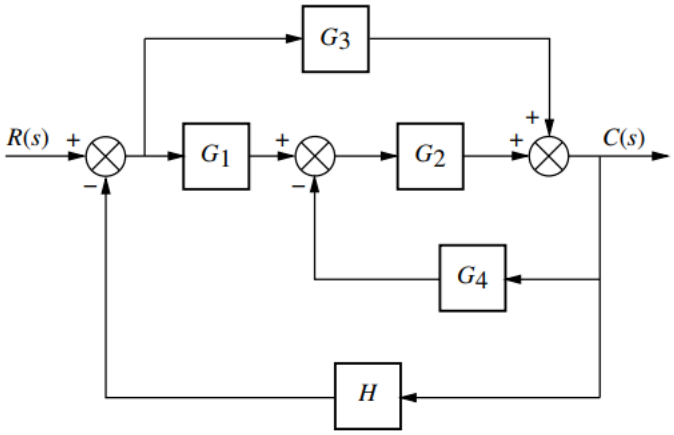
1. Derive the Laplace transform for the following time functions (5'*2+10'*4=50')

a. $u(t)$
b. $tu(t)$
c. $sin\omega t\ u(t)$
d. $cos\omega t\ u(t)$
e. $e^{-at}sin\omega t\ u(t)$
f. $t^3u(t)$

2. Reduce the block diagram shown in figures below, derive $T(s) = C(s)/R(s)$ (Please write detailed reduction process) (15'+20'=35')





3. A system is described by the following differential equation:

$$\frac{d^3y}{dt^3} + 3\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + y = \frac{d^3x}{dt^3} + 4\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 8x$$

Find the expression for the transfer function of the system, $Y(s)/X(s)$ (15')