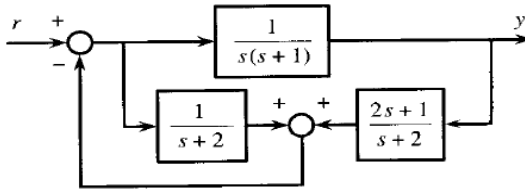


**Automatic Control System**  
**2<sup>nd</sup> year Electrical Dept.**  
**6 May 2010**

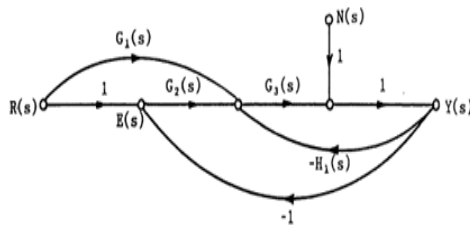
**Question 1** [10 Marks]

Find the transfer function  $\frac{Y(s)}{R(s)}$  of the system shown below



**Question 2** [10 Marks]

Find the Transfer function  $\frac{Y(s)}{R(s)} \Big|_{N(s)=0}$



**Question 3** [10 Marks]

Consider the temperature control system shown below. The problem is to control the temperature  $y$  inside the chamber. The chamber is heated by steam. The flow  $q$  of hot steam is proportional to the valve opening  $x$ ; that is,  $q = k_q x$ . The valve opening  $x$  is controlled by a solenoid and is assumed to be proportional to the solenoid current  $i$ ; that is,  $x = k_s i$ . It is assumed that the chamber temperature  $y$  and the steam flow  $q$  are related by  $\frac{dy}{dt} = -cy + k_c q$  where  $c$  depends on the insulation and the temperature difference

between inside and outside the chamber. To simplify analysis and design  $c$  is assumed to be a positive constant. This means that if no steam is pumped into the chamber, the temperature will decrease at the rate of  $e^{ct}$ . Find  $\frac{Y(s)}{R(s)}$

