3(a)

$$J_m \ddot{\theta}_m + \left(B_m + \frac{K_b K_m}{R}\right)\dot{\theta} = \left(\frac{K_m}{R}\right)V - rT_q$$

$$V = k_p\left(\theta^d_{m_k} - \theta_{m_k}\right) \cdot - k_D \dot{\theta}_{m_k}$$

3b.

$$J_{eff}\ddot{e} + \left(B_{eff} + K_m K_D\right)\dot{e} + k_m K_p e = r\omega(t)$$

3c.

Here, $d^q = \sum d_{jk}(q^d)\ddot{q}^d_j + \sum C_{ijk}(q^d)\dot{q}^d_i\dot{q}^d_j + g_k(q^d)$

$V(t) = f(t) + K_D\dot{e}(t) + K_p e(t) + rd^d$

3d. $\left(\ddot{q}^d \otimes \ddot{q}(t)\right) + k_L\left(\dot{q}^d(t) - \dot{q}(t)\right) + k_o\left(q^d(t) - q(t)\right) = 0$