

السؤال الأول: (5 درجة)

Test the Controllability and the Observability of the following systems

$$A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 3 & 1 \end{bmatrix}; B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}; C = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

السؤال الثاني: (5 درجات)

Find the constant gains vector k , if the required parameters of the new system are:

$$\zeta = 0.3 \text{ and } w_n = 10 \text{ rad/sec}$$

$$A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}; b = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

السؤال الثالث: (10 درجات)...

Consider the state space system described by $\dot{x} = Ax + Bu$ where:

$$A = \begin{bmatrix} 0 & 1 \\ 0 & -1 \end{bmatrix}; b = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

The performance index J is given by: $J = \int_0^{\infty} (\dot{x} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} x + u \begin{bmatrix} 1 \\ 1 \end{bmatrix} u) dt$ Assume the following control u is used. $u = -Kx$ (3 - 2)Determine the optimal feedback gain matrix K .Note that the Riccati equation is: $A^T P + PA - PBR^{-1}B^T P + Q = 0$

$$k_r = R^{-1} B^T x$$

$$k_r = \begin{bmatrix} 1 & 1 \end{bmatrix}$$