

3F2 Systems and Control: 2012 Answers

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1. (a) —
(b) —
(c) —
(d) —
(e) —

$$x(t) = \begin{bmatrix} 1 - e^{-t} \\ 1 - 2e^{-t} + e^{-2t} \end{bmatrix}$$

2. (a) —

$$\dot{x} = \begin{bmatrix} \dot{\theta} \\ \ddot{\theta} \\ \dot{v} \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 0 & -1 \end{bmatrix} \begin{bmatrix} \theta \\ \dot{\theta} \\ v \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \\ -1 \end{bmatrix} u$$

- (b) —
(c) —
(d) —

3. (a) —
(b) i. —

$$H(s) = \frac{s(s+0.1)(s+0.2)}{(s^2+0.02)(s^2+s+5)}$$

- ii. —
iii. —
(c) —

4. (a) —
(b) —
(c) —
(d) Observable.