Concept Question 3-10: Why is a system with an improper transfer function always BIBO unstable?

The partial fraction expansion of an improper $\mathbf{H}(\mathbf{s})$ includes a term proportional to $\mathbf{s}$. See Eq. (3.104) for an example. Consider a bounded input $x(t) = u(t)$. Then $\mathbf{X}(\mathbf{s}) = 1/\mathbf{s}$ and $\mathbf{Y}(\mathbf{s}) = \mathbf{H}(\mathbf{s})\,\mathbf{X}(\mathbf{s})$ includes a constant term, whose inverse Laplace transform is an impulse, so the output is unbounded.