

ELL205 Signals and Systems
Minor- I Examination, 25 marks, Aug., 2018

Each question carries 5 marks

1. (a) Find the fundamental period of the signal

$$x[n] = 2 \sin\left(\frac{6\pi n}{7}\right) + 3 \cos\left(\frac{2\pi n}{3}\right)$$

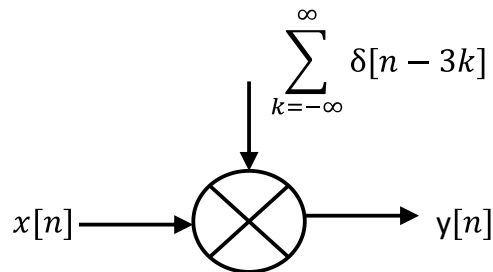
- (b) Let $y[n] = x[2n]$. Prove or disapprove with complete justification the following statements:

- (i) $x[n]$ periodic implies that $y[n]$ is also periodic
- (ii) $y[n]$ periodic implies that $x[n]$ is also periodic

2. (a) Let $y[n] = e^{2x[n-2]}$

where $x[n]$ and $y[n]$ are input and output of the system respectively. Is this system (i) stable (ii) Invertible (iii) Time-invariant

- (b) Is the system shown below time-varying or time-invariant? Justify your answer.



3. The unit-step response $s[n]$, that is response of the system to $u[n]$, of a discrete-time linear time-invariant (LTI) system is:

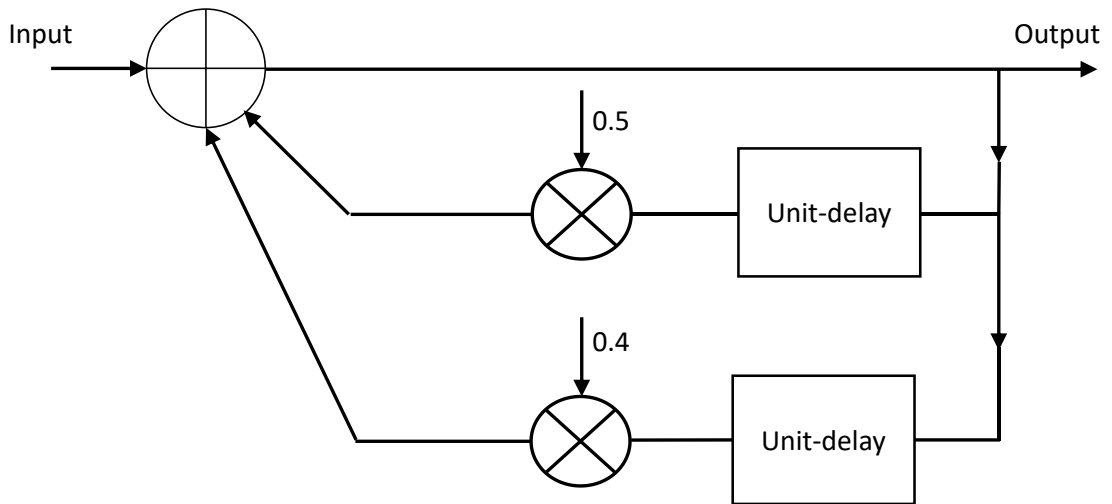
$$s[n] = e^{\beta n} u[n]$$

Find the output of the system if the input $x[n]$ is:

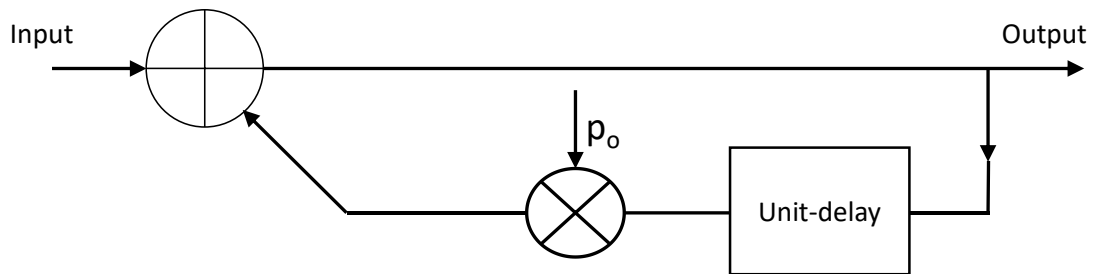
$$x[n] = e^{\alpha n} u[n] - e^{\alpha[n-1]} u[n-1],$$

for $\alpha, \beta < 0$.

4. Consider a discrete-time LTI system implemented using unit-delays, multipliers and an adder as shown below:



Assuming that the above system starts at rest, we replace the above system with an equivalent discrete-time LTI system which is as shown below:



Find the value of p_0 . Is the system stable? Justify.

5. Consider the causal LTI system described by the following difference equation:

$$y[n] = 2x[n] + 3x[n - 1] - y[n - 2]$$

If the impulse response $h[n]$ of the system is

$$h[n] = \{Aj^n + B(-j)^n\}u[n]$$

where $j = \sqrt{-1}$. Find A and B .