In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
from math import cos, pi
```

Resolução - Questão 1

In [2]:
```
def u(n):
    if n >= 0:
        return 1
    else:
        return 0
```

In [3]:
```
def h(n):
    return pow(0.7, n) * (u(n) - u(n - 5))
```

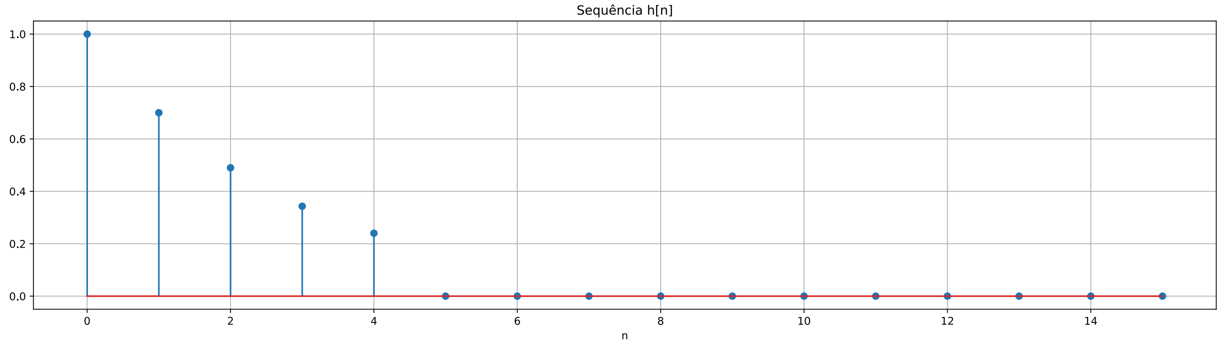
In [4]:
```
def r(n):
    if (n >= 0) and (n <= 9):
        return 1
    else:
        return 0
```

In [5]:
```
#Gerando um range de valores n de 0 a 15
#Valores negativos para n nao serao necessarios, dado que:
#[h(n) = 0, n < 0] e [r(n) = 0, n < 0]
n_seq = range(16)
```

In [6]:
```
#Gerando sequencias h[n] e r[n]
h_seq = [h(n) for n in n_seq]
r_seq = [r(n) for n in n_seq]
```

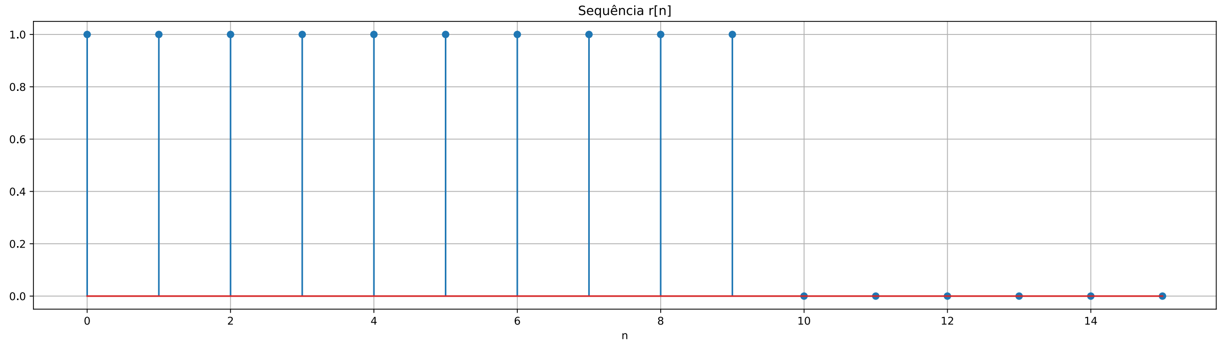
In [7]:
```
#inicializando y_seq com valores nulos
y_seq = [0 for i in range(16)]

#Pela definição da soma de convolução
for n in n_seq:
    soma = 0
    for k in range(16):
        soma+= r(k) * h(n - k)
    y_seq[n] = soma
```

In [8]:
```
plt.figure(figsize=(20, 5))
plt.xlabel("n")
plt.title("Sequência h[n]")
plt.stem(n_seq, h_seq)
plt.grid()
```



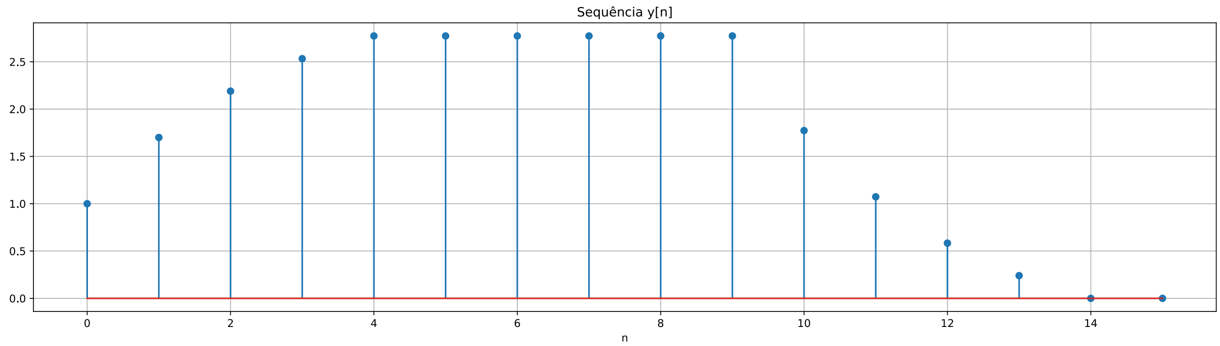
In [9]:

```
plt.figure(figsize=(20, 5))
plt.xlabel("n")
plt.title("Sequência r[n]")
plt.stem(n_seq, r_seq)
plt.grid()
```



In [10]:

```
plt.figure(figsize=(20, 5))
plt.xlabel("n")
plt.title("Sequência y[n]")
plt.stem(n_seq, y_seq)
plt.grid()
```



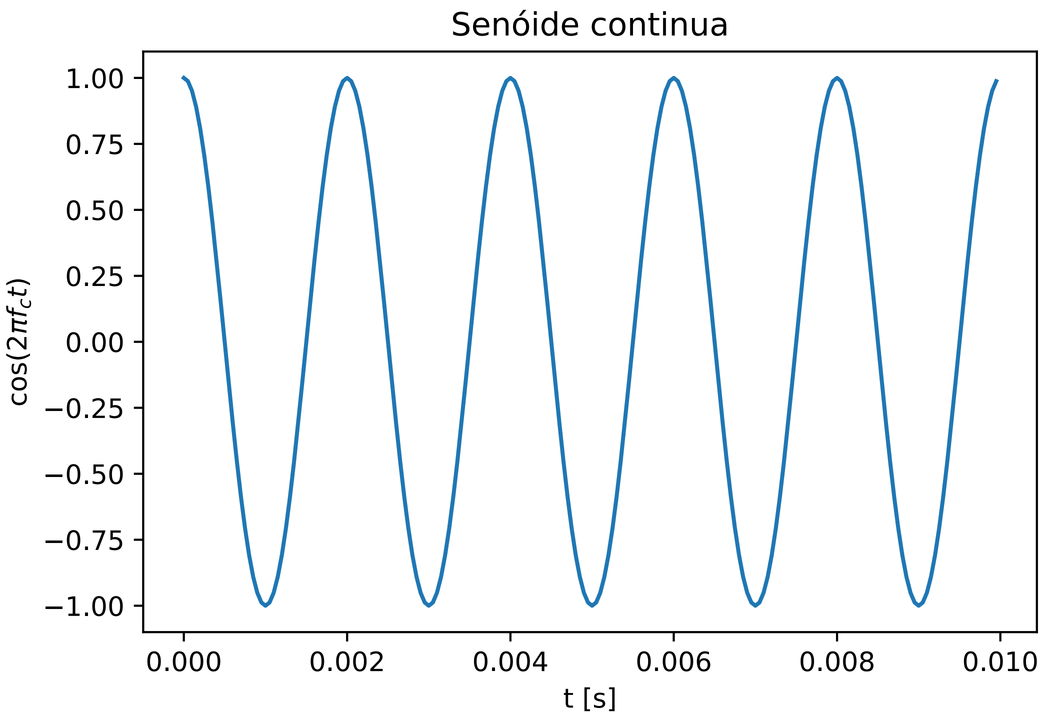
Resolução - Questão 2

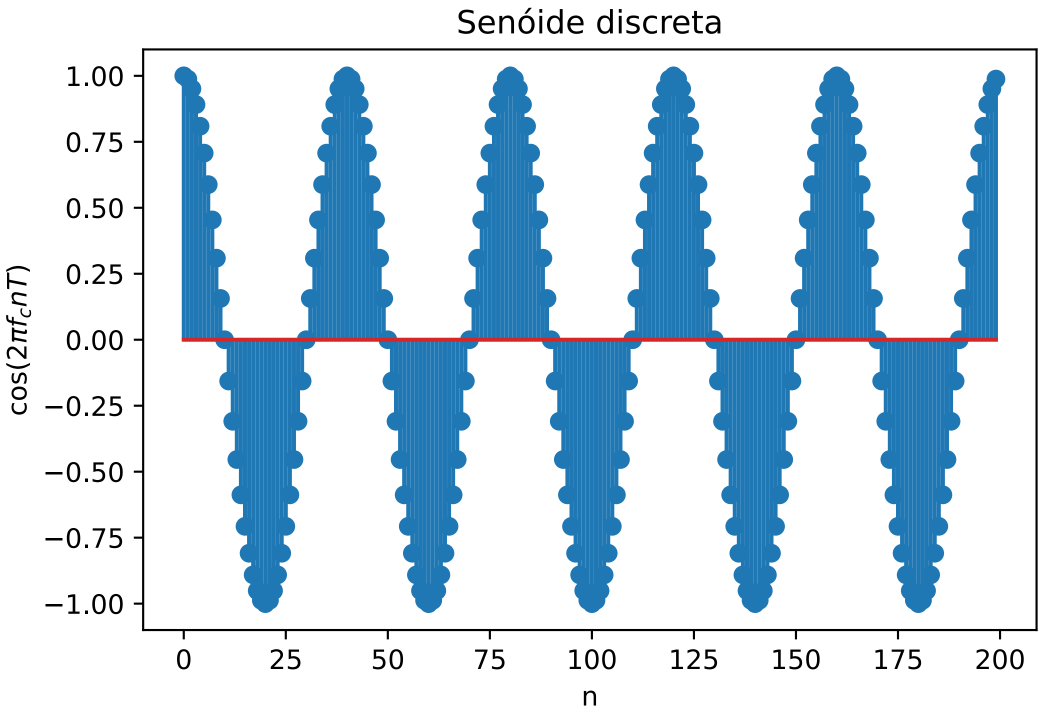
In [11]:

```
### Frequencia da funcao cosseno gerada
f_c = 500 # 500 Hz

### Periodo de amostragem
fs = 20000 # Freq de amostragem = 20 kHz
T = 1/fs

### Numero de amostras em 1s
ns = fs*1

### Inicializacao de arrays para coletar 1s de dados
```

```
input  = [0]*ns
t_axis = np.arange(0., ns)*T

### Funcao cosseno amostrada ate 1s
for i in range(ns):
    input[i] = cos(2 * pi * f_c * i * T)


### Seleciona amostras do cosseno: #1/100 de 1s
n_plot=200
t_plot = t_axis[0:n_plot]
input_section = input[0:n_plot]

### Plot da funcao cosseno continua (funcao plot "simula" uma funcao continua
plt.figure(1)
plt.ylabel('cos($2\pi f_c t$)')
plt.xlabel('t [s]')
plt.title('Senóide continua')
plt.plot(t_plot,input_section)

### Plot da funcao cosseno amostrada com fs = 20 kHz
plt.figure(2)
plt.ylabel('cos($2\pi f_c n T$)')
plt.xlabel('n')
plt.title('Senóide discreta')
plt.stem(input_section, use_line_collection=True)
```

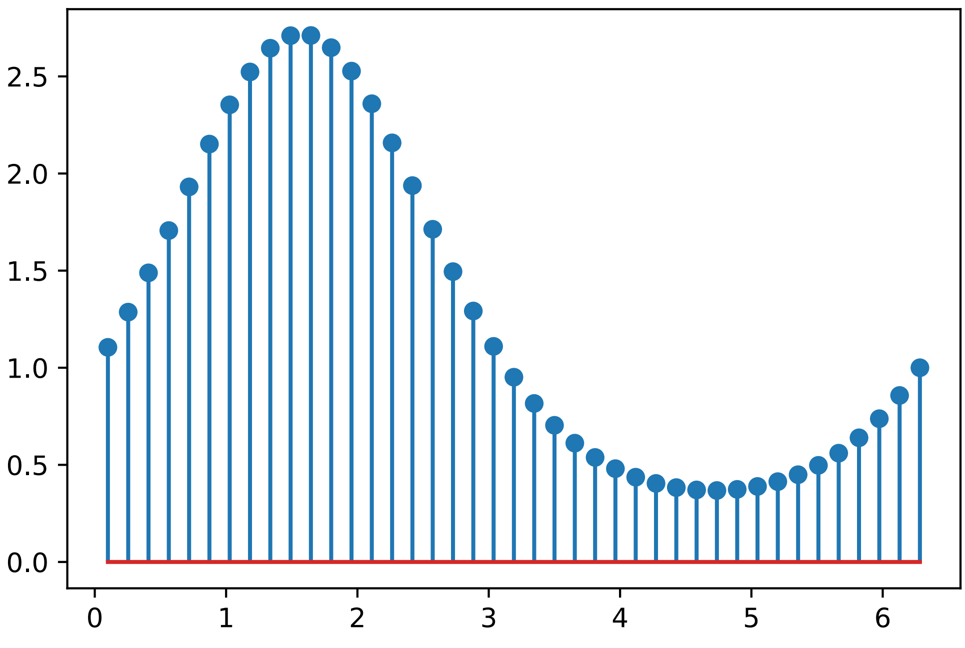
Out[11]:
```
<StemContainer object of 3 artists>
```





In [12]:

```
x = np.linspace(0.1, 2 * np.pi, 41)
y = np.exp(np.sin(x))

plt.stem(x, y, use_line_collection=True)
plt.show()
```



In [13]:

```
print(x)
print(y)
```

```
[0.1        0.25457963 0.40915927 0.5637389  0.71831853 0.87289816
 1.0274778  1.18205743 1.33663706 1.49121669 1.64579633 1.80037596
 1.95495559 2.10953522 2.26411486 2.41869449 2.57327412 2.72785376
 2.88243339 3.03701302 3.19159265 3.34617229 3.50075192 3.65533155
 3.80991118 3.96449082 4.11907045 4.27365008 4.42822972 4.58280935
 4.73738898 4.89196861 5.04654825 5.20112788 5.35570751 5.51028714
 5.66486678 5.81944641 5.97402604 6.12860567 6.28318531]
[1.10498683 1.28638841 1.48860305 1.70633924 1.93115757 2.15156296
```

```
 2.35372172 2.52284638 2.64510234 2.70969264 2.71065097 2.64788748
 2.52720475 2.35927974 2.15788679 1.93781443 1.71294765 1.49486448
 1.29209894 1.11003229 0.95124924 0.81615126 0.70364081 0.61174673
 0.53812353 0.4804078  0.43644636 0.40442535 0.38293206 0.3709766
 0.36799442 0.37384318 0.38880149 0.41357117 0.44927975 0.49747353
 0.5600855  0.63935511 0.73767062 0.85730223 1.        ]
```