8.40 Write a MATLAB script that uses *f_elliptics* to design an analog elliptic lowpass filter to meet the following design specifications.

$$[F_p, F_s, \delta_p, \delta_s] \quad = \quad [10, 20, 0.04, 0.02]$$

(a) Print the filter order

(b) Use *f_freqs* to compute and plot the magnitude response for $0 \leq f \leq 2F_s$.

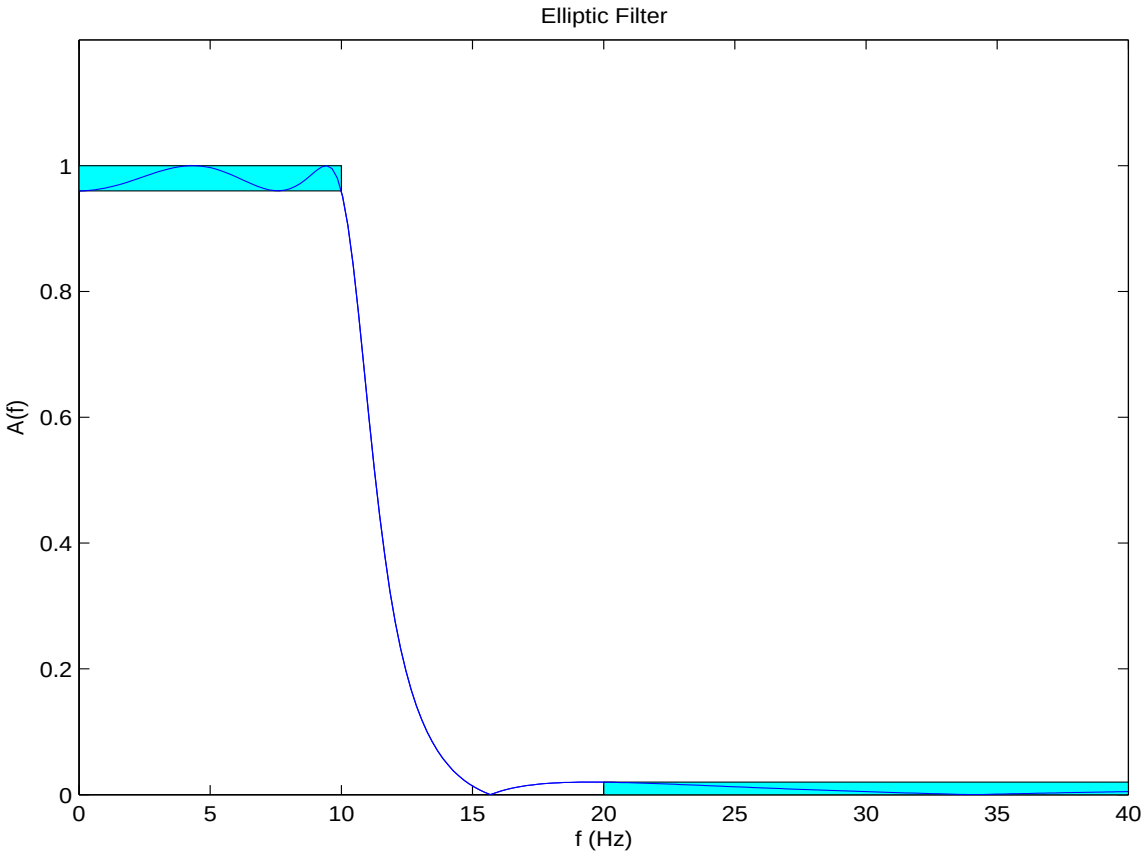
(c) Use *fill* to add shaded areas showing the design specifications on the magnitude response plot.

Solution

```
% Problem 8.40

% Initialize

clear
clc
F_p = 10;
F_s = 20;
delta_p = 0.04;
delta_s = 0.02;

% Design filter

[b,a] = f_elliptics (F_p,F_s,delta_p,delta_s);
n = length(a)-1

% Plot magnitude response

figure
f_max = 2*F_s;
N = 200;
[H,f] = f_freqs (b,a,N,f_max);
A = abs(H);
plot (f,A)
f_labels ('Elliptic Filter','f (Hz)','A(f)')
axis([0 f_max 0 1.2])

% Show specifications

hold on
fill ([0 F_p F_p 0],[1-delta_p, 1-delta_p, 1, 1],'c')
fill ([F_s f_max f_max F_s],[0 0 delta_s delta_s],'c')
plot (f,A)
f_wait
```

The printed filter order is

```
n =
     4
```



Elliptic Lowpass Magnitude Respnose with Design Specifications