ETI 2403 ANALOGUE FILTERS
LAB II: APPROXIMATION THEORY

Task 1: First order transfer functions

Plot the magnitude-squared response and phase response for the following first order low pass filters

$$H(j\omega) = \frac{K}{j\omega + \mu} \qquad K = \mu = 100$$

$$H(j\omega) = \frac{K(j\omega + \gamma)}{j\omega + \mu} \qquad \mu = 100, \gamma = 10000 \; and \; K = {}^{\mu}/_{\gamma}$$

**Magnitude-squared response plots should be of ω on logarithmic x-axis versus $|H(j\omega)|^2$ in dB on the y-axis

State your observations on the roll-off behavior of the magnitude-squared response.

Task 2: Second order transfer functions

a. Repeat task 1 above for the following second order transfer functions

$$H(s) = \frac{K}{s^2 + \varepsilon s + \alpha} \qquad where \; \omega_o = 1, K = 1$$

Do this for the following values of Q. $Q = \{0.25 \; , \; 1 \; , \; 10\}$. Place all plots on the same set of axis

NB: $\omega_o = \alpha, \; Q = {}^{\omega_o}/_{\varepsilon}$

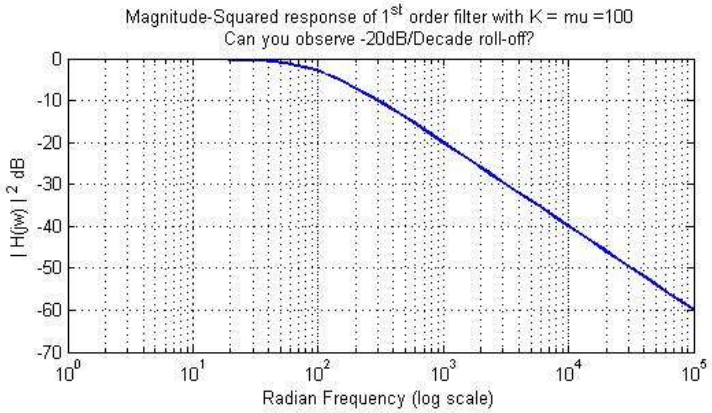
b. Repeat part (a) above for the following transfer function

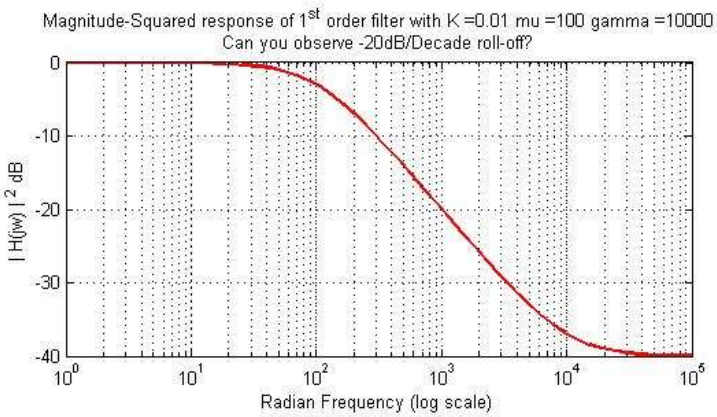
$$H(s) = \frac{K(s + \beta)}{s^2 + \varepsilon s + \alpha} \qquad where \; \omega_o = 1, K = 1, \beta = 100, \frac{K^2\beta^2}{\alpha^2} = 1$$

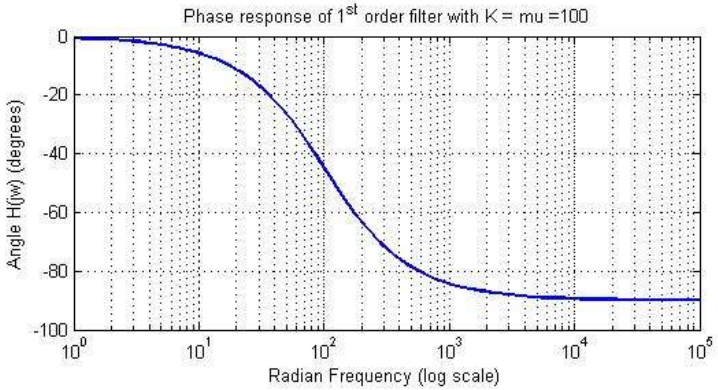
Expected results

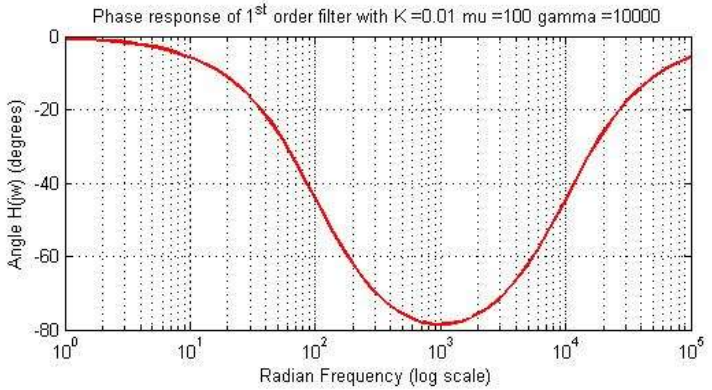
Task 1

Task 1 expected result

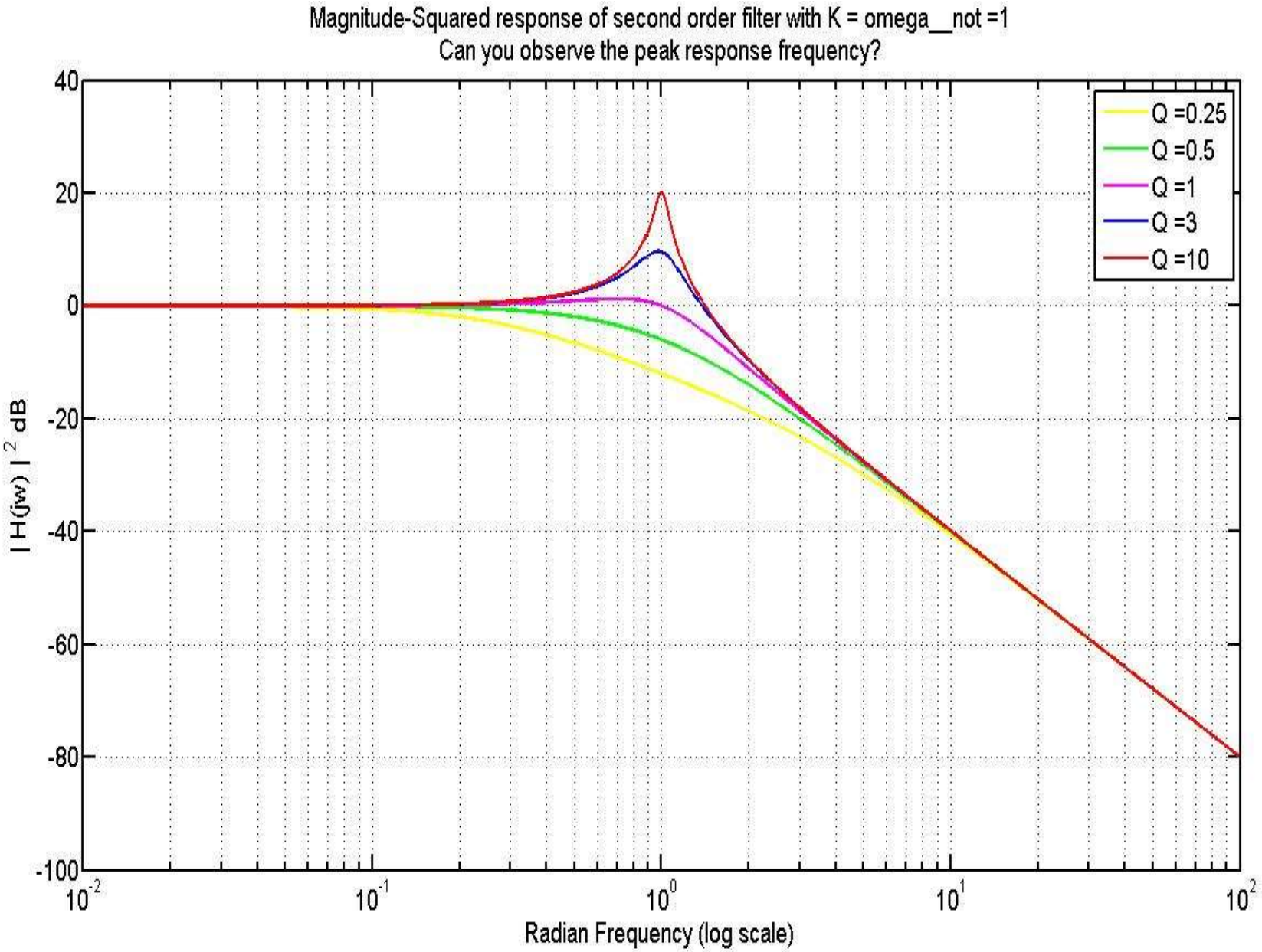


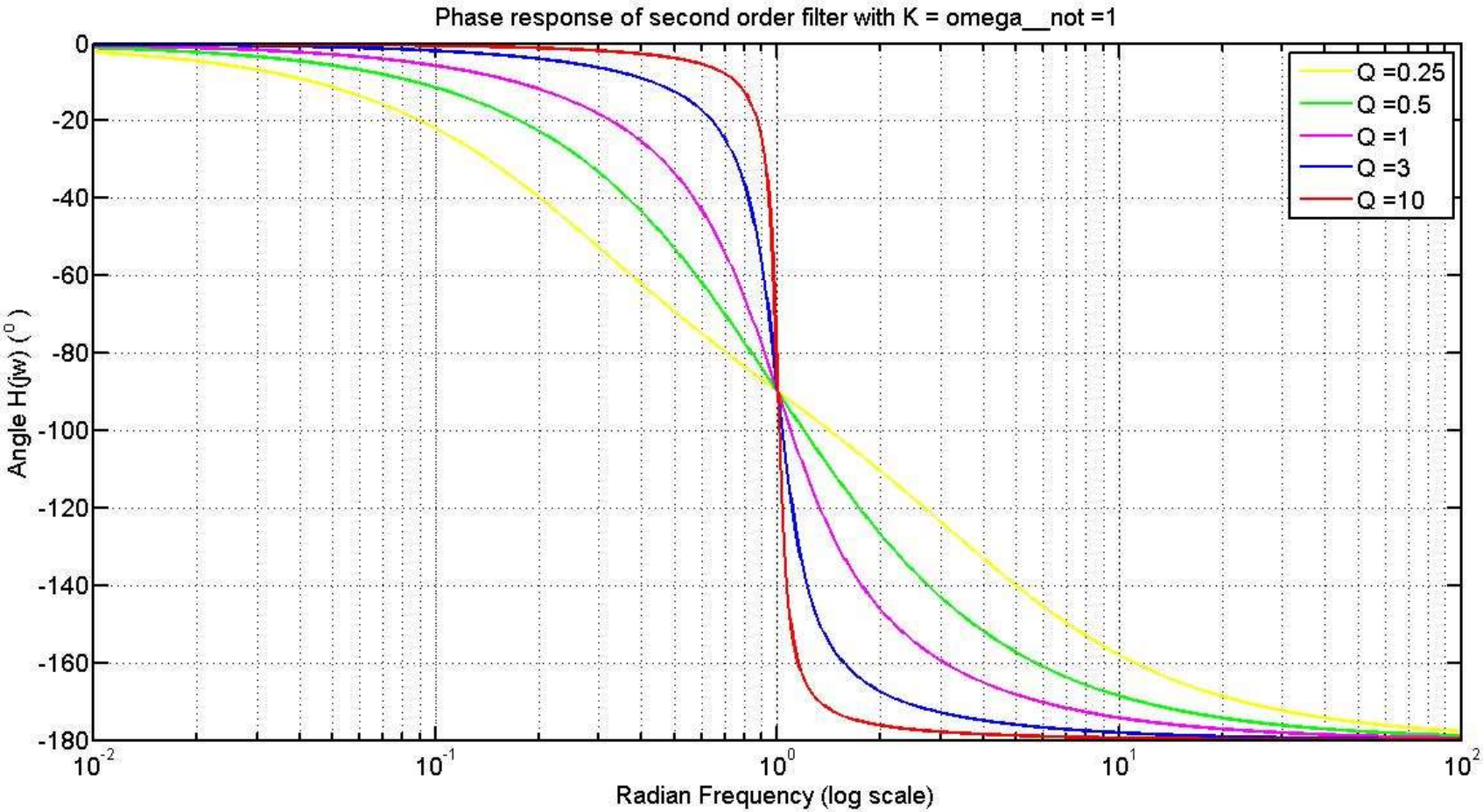




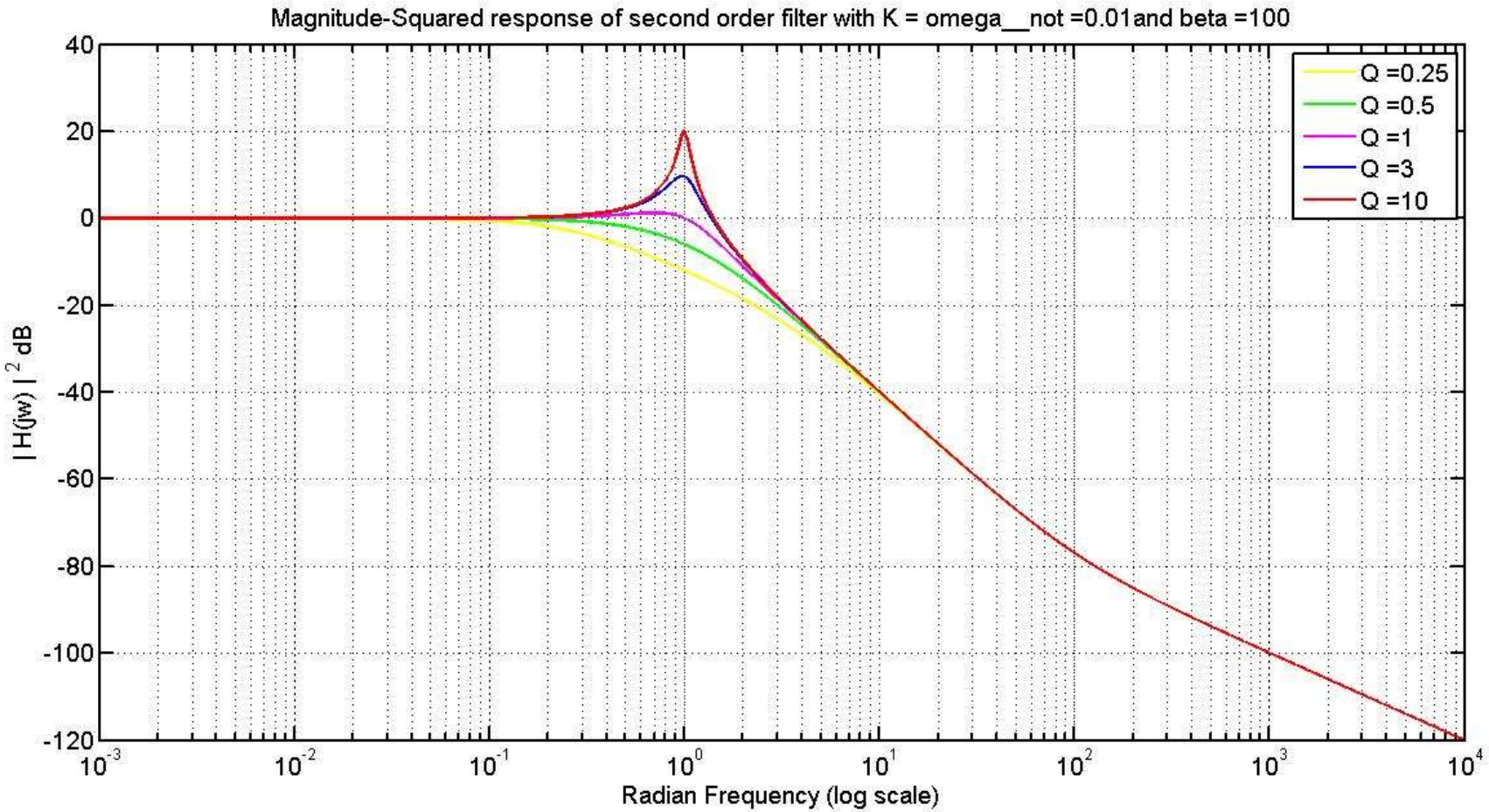


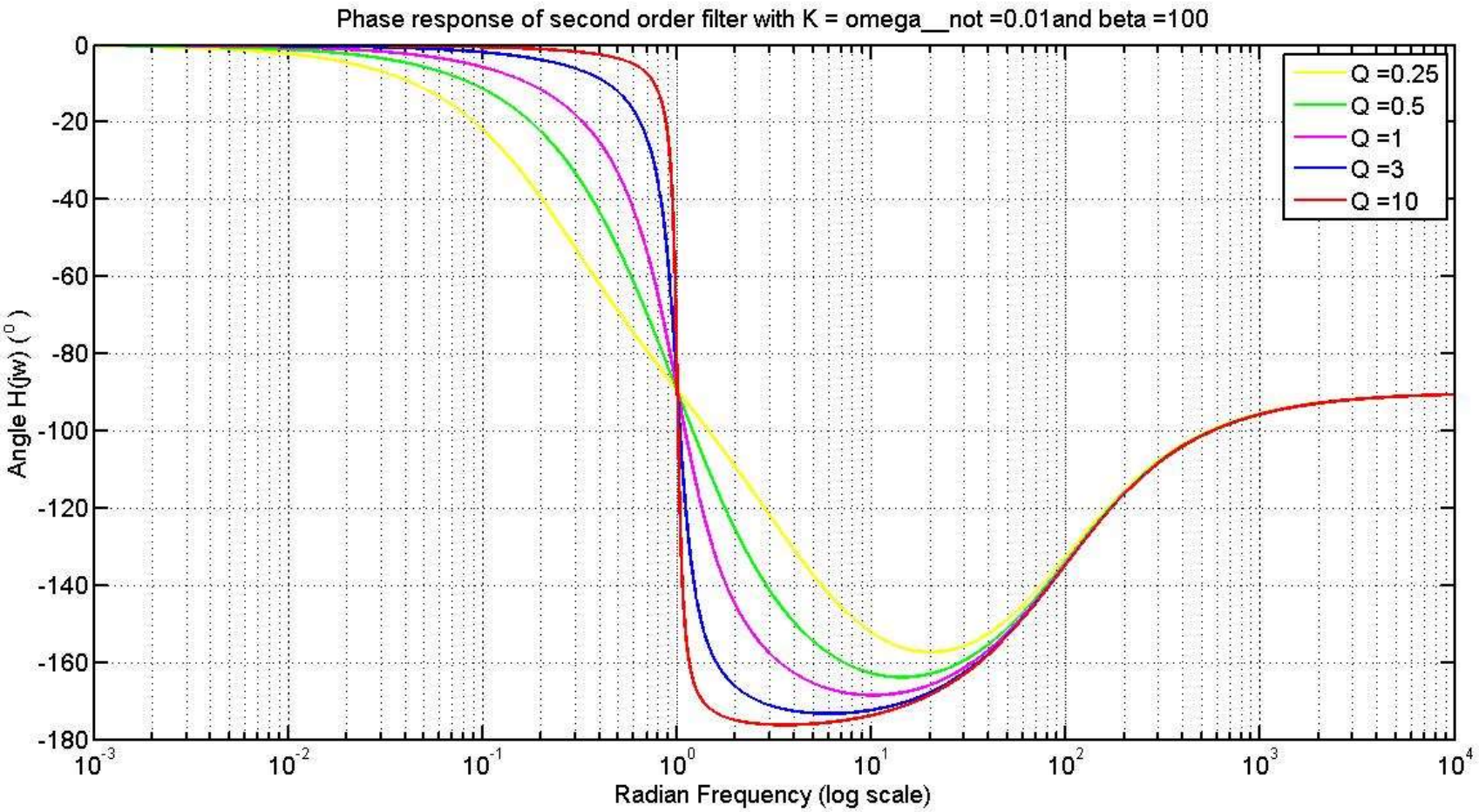
Task 2(a) expected result




Phase response of second order filter with K = omega__not =1
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
Angle H(jw) (°)
10^-2
10^-1
10^0
10^1
10^2
Radian Frequency (log scale)
Q =0.25
Q =0.5
Q =1
Q =3
Q =10

Task 2(b) expected result




Phase response of second order filter with K = omega__not =0.01and beta =100
Angle H(jw) (°)
Radian Frequency (log scale)
Q =0.25
Q =0.5
Q =1
Q =3
Q =10
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
10^-3
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4