THE UNIVERSITY OF SOUTH AUSTRALIA

PRACTICE EXAM

EEET3041

Signals and Systems

PART OPEN BOOK

TIME: for working

for perusal before examination begins

Each question worth 8 marks

1. Suppose that x is the signal with Fourier transform

$$\hat{x}(f) = \frac{1}{(f - j)^4}.$$

Sketch the magnitude of $\hat{x}$ and find and sketch the time domain signal x. Is x absolutely integrable? Is x square integrable?

2. Sketch the sequence

$$x_n = \left(\tfrac{4}{5}\right)^n \sin(\pi n/2) u_n$$

where u_n is the step sequence. Find the discrete time Fourier transform of x.

3. Show that the differential equation relating the force f and position p of the mass-spring-damper in Figure 1 is

$$f = Kp + BD(p) + MD^2(p).$$

Find the transfer function of a linear time invariant system H that maps the input force signal f to the output position signal p. Assuming that the constants satisfy

$$M = 1 \qquad K = \frac{\pi^2}{16} \qquad B = \frac{\pi}{2},$$

draw a pole zero plot for this system and find and sketch the impulse response. Comment on whether the system is underdamped, overdamped, or critically damped.
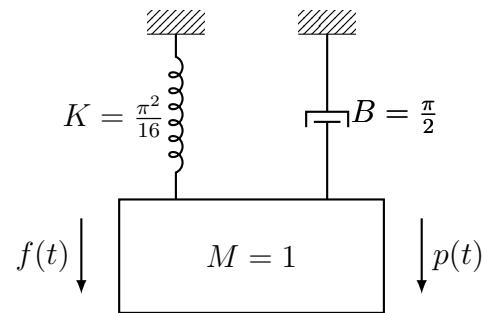
Figure 1: A mechanical mass-spring-damper system