Exam1

ⓘ This is a preview of the published version of the quiz

Started: Dec 9 at 7:33pm

Quiz Instructions

This exam is open book, open notes, you may use any online/hardback textbooks you like. You may use calculators and matlab, but may not collaborate with other people. All multiple choice and fill-in-the-blank answers should be within 5% of correct value.

Unless stated otherwise in the question, use 1 decimal precision in fill-in-the blank questions, such as "132.3" or "58.0" for example. Also, canvas might force you to enter a leading "0" for numbers less than one, such as "0.11" and entries such as ".11" might be disallowed.

As always, make sure that you are in a location with good internet connectivity during the exam. It is not a bad idea to practice tethering through your cellphone as a backup to your regular internet access. Make sure your browser is compatible with canvas.

I may monitor my email tpweldon@uncc.edu (mailto:tpweldon@uncc.edu) during the exam, in case of some major urgent issue during the exam. Because the exam is online, most issues will have to wait until after the exam is completed, so do not expect any reply to any email, and **proceed on** with the exam even if you send an email.

Question 1 5 pts

For the two vectors $\mathbf{v_1}$=[-1 2 -2]^T and $\mathbf{v_2}$=[3 2 1]^T the inner product , or dot product, is

Question 2 5 pts

If the initial kinetic energy of a 2 kg mass is 5 J, and a constant force of 7 N is applied over a distance of 6 M, the final kinetic energy in J is

Question 3 5 pts

A sound pressure level of 0.04 Pa rms, would correspond to a level L_p in dB_{SPL} units of

- 60
- None Above
- 63
- 66

Question 4 5 pts

A sound intensity level of 0.005 W/m^2 rms, would correspond to a level L_I in dB_{SIL} units of

- 97
- None Above
- 80
- 66

Question 5 5 pts

At temperature 290 K, the density of propane is 2 kg/m^3 with γ = 1.1 at a pressure of 100 kPa. Under these conditions, the compressibility in Pa^{-1} is κ =

- 7.7 x 10^{-6}
- 3.2 x 10^{-4}
- 9.1 x 10^{-6}
- None above

Question 6 5 pts

Assume a 13 m long piston of 0.001 m^2 area is filled with fluid with

mass density of ρ=243 kg/m^3

and compressibility of κ=10^{-3} Pa^{-1}.

The piston has an equivalent electronic resistance in ohms of R=

Question 7 5 pts

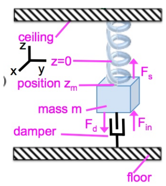
Assume a 6 m long piston of 0.0005 m^2 area is filled with fluid with

mass density of ρ=16 kg/m^3

and compressibility of κ=10^{-3} Pa^{-1}.

The piston is equivalent to a capacitor in farads of C=

Question 8 20 pts



Assume the mechanical oscillator above having the following properties:

mass m =0.04 kg

spring compliance n=0.25 m/N

mechanical resistance r=0.1 N/(m/s)

NOTE: you must use dropdown menus below to answer **all parts** of this question.

Part 1: The natural frequency of the mechanical oscillator in rad/s is ω_0=

[Select]

Part 2: The damping factor of the mechanical oscillator is δ=

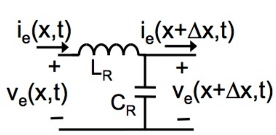
[Select]

Part 3: The damping ratio of the mechanical oscillator is ζ=

[Select]

Part 4: The Q of the mechanical oscillator is Q= [Select]

Question 9 10 pts



Assume the LC transmission line above has the following properties:

inductance per unit length L_R =800 nH/m

capacitance per unit length C_R=200 pF/m

signal frequency f=10^6 Hz

NOTE: you must use dropdown menus below to answer **all parts** of this question.

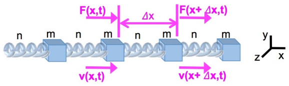
Part 1: The phase velocity in m/s of the signal in the LC transmission line is v_p=

[Select]

Part 2: The characteristic impedance of the transmission line in ohms is Z_0=

[Select]

Question 10 20 pts



Assume the mechanical transmission line above with the following properties:

linear mass density m_R =0.5 kg/m

compliance-per-meter n_R=0.02 N^{-1}

mechanical signal frequency f=1000 Hz

NOTE: you must use dropdown menus below to answer **all parts** of this question.

Part 1: The phase velocity of the mechanical wave in m/s is v_p=

[Select]

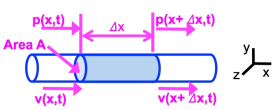
Part 2: The wavelength in meters of the mechanical wave is λ=

[Select]

Part 3: The wavenumber, or spatial frequency, of the mechanical wave in rad/m is β= [Select]

Part 4: The characteristic impedance of the mechanical transmission line in N s/m^3 is Z_0= [Select]

Question 11 20 pts



Assume the acoustic transmission line above is filled with a fluid and has the following properties:

cross-sectional area A=0.001 m^2

mass density ρ_R =16 kg/m^3

compressibility κ_R=10^{-8} Pa^{-1}

acoustic signal frequency f=100 Hz

NOTE: you must use dropdown menus below to answer **all parts** of this question.

Part 1: The phase velocity of the acoustic wave in the fluid in m/s is v_p=

[Select]

Part 2: The wavelength in meters of the acoustic wave in the fluid is λ=

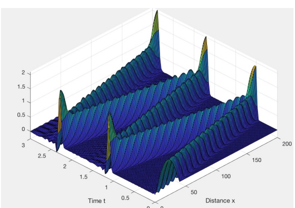
[Select]

Part 3: The wavenumber, or spatial frequency, of the acoustic wave in the fluid in rad/m is β= [Select]

Part 4: The characteristic impedance of the acoustic transmission line in N s/m^3 is Z_0= [Select]

Question 12

15 pts



The simulation above is for an acoustic transmission line filled with an unknown gas, and shows multiple reflections up and down the line, similar to our experiments in class. For the figure, time is in seconds and distance is in meters.

NOTE: you must use dropdown menus below to answer **all parts** of this question.

Part 1: The total distance traveled by the acoustic pulse in the simulation is most nearly [Select]

Part 2: The total time for the pulse to travel over the total distance in the simulation is most nearly [Select]

Part 3: The group velocity in of the pulse is most nearly

[Select]

Question 13

5 pts

For the scalar pressure field $p(x,y,z,t)=3x^2ze^{j100t}$

the gradient is $\nabla p(x,y,z,t)$ =

- none above
- $[0\ \ 3y^2z\ \ y^3]^T$
- $[6z\ \ 0\ \ 0]^T\ e^{j100t}$
- $[0\ \ 0\ \ 6z]^T\ e^{j100t}$
- $[\ 6xz\ \ 0\ \ 3x^2]^T\ e^{j100t}$

Quiz saved at 7:33pm Submit Quiz