In-Class Activities

ICA 10-1

You want to set up a worksheet to investigate the oscillatory response of an electrical circuit. Create a worksheet similar to the one shown, including the proper header information.

α_0 ω_0 V_0 ω_d

4			
5			
6			
7	Neper Frequency (α_0)	25	[rad/s]
8	Resonant Frequency (ω_0)	400	[rad/s]
9	Initial Voltage (V_0)	15	[V]
10			
11	Damped Frequency (ω_d)		[rad/s]
12			
13			
14	Time (t) [s]	Voltage (V) [V]	
15			

First, calculate another constant, the damped frequency ω_d, which is a function of the neper frequency (α_0) and the resonant frequency (ω_0). This can be calculated with the formula

$$\omega_d = \sqrt{\omega_0^2 - \alpha_0^2} = \sqrt{\omega_0^2 - \alpha_0^2}$$

Next, create a column of times (beginning in A15) used to calculate the voltage response, ranging from 0 to 0.002 seconds at an increment of 0.0002 seconds.

In column B, calculate the voltage response with the following equation, formatted to one decimal place:

$$V = V_0 e^{-\alpha_0 t} \cos(\omega_d t) = V_0 e^{-\alpha_0 t} \cos(\omega_d t)$$

(a) Change neper frequency to 200 radians per second, resonant frequency to 800 radians per second, and initial voltage to 100 volts. At a time of 0.0008 seconds, what is the voltage?

(b) Change neper frequency to 100 radians per second, resonant frequency to 600 radians per second, and initial voltage to 100 volts. At a time of 0.0008 seconds, what is the voltage?

(c) Change neper frequency to 200 radians per second, resonant frequency to 400 radians per second, and initial voltage to 75 volts. At a time value of 0.0008 seconds, what is the voltage?

ICA 10-3

Refer to the following worksheet. The following expressions are typed into the Excel cells indicated. Write the answer that appears in the cell listed. If the cell will be blank, write "BLANK" in the answer space. If the cell will return an error message, write "ERROR" in the answer space.

	A	B	C	D	E	F	G	H
1								
2								
3	Fluid Type	Benzene			Fluid Type	Olive Oil		
4	Density (ρ)	0.879	[g / cm^3]		Density (ρ)	0.703	[g / cm^3]	
5	Viscosity (μ)	6.47E-03	[g / (cm s)]		Viscosity (μ)	1.01	[g / (cm s)]	
6								
7	Velocity (v)	15	[cm / s]		Velocity (v)	50	[cm / s]	
8								
9	Pipe Diameter	Reynolds Number			Pipe Diameter	Reynolds Number		
10	(D) [cm]	(Re) [–]			(D) [cm]	(Re) [–]		
11	1.27	2,588			1.27	44		
12	2.54	5,176			2.54	88		
13	3.81	7,764			3.81	133		
14	5.08	10,352			5.08	177		
15	6.35	12,940			6.35	221		
16	7.62	15,529			7.62	265		

The following sample worksheet is shown for comparison.

Specific Gravity of Material	(SG)	1.50	[--]
Diameter	(D)	4.0	[in]
Cost of Raw Material	(C)	$2.25	[$ / lb_m]
Number of Parts	(N)	150	[--]
Radius	(R)	5.08	[cm]
Density of Fluid	(ρ)	1.5	[g / cm^3]

Height (H) [cm]	Volume (V) [cm^3]	Mass (m) [g]	Mass (M_N) [lb_m] for N parts	Total Material Cost (MC) [$]
1	81.07	121.61	40	$90.50
2	162.15	243.22	80	$181.00
3	243.22	364.83	121	$271.50
5	405.37	608.05	201	$452.50
6	486.44	729.66	241	$543.00
8	648.59	972.88	322	$724.00
10	810.73	1216.10	402	$905.00
12	972.88	1459.32	483	$1,086.01

Labor Cost	(LC)	$1.75 [$ / part]

	Total Cost of N Parts	Energy Cost (EC) [$ / part]			
Height (H) [cm]	Total Material Cost (MC) [$]	$0.05	$0.10	$0.20	$0.40
1	$90.50	$360.50	$368.00	$383.00	$413.00
2	$181.00	$451.00	$458.50	$473.50	$503.50
3	$271.50	$541.50	$549.00	$564.00	$594.00
5	$452.50	$722.50	$730.00	$745.00	$775.00
6	$543.00	$813.00	$820.50	$835.50	$865.50
8	$724.00	$994.00	$1,001.50	$1,016.50	$1,046.50
10	$905.00	$1,175.00	$1,182.50	$1,197.50	$1,227.50
12	$1,086.01	$1,356.01	$1,363.51	$1,378.51	$1,408.51

ICA 10-10

Refer to the following worksheet. The following expressions are typed into the Excel cells indicated. Write the answer that appears in the cell listed. If the cell will be blank, write "BLANK" in the answer space. If the cell will return an error message, write "ERROR" in the answer space.

	A	B	C	D	E	F	G	H
1								
2								
3	Fluid Type	Benzene			Fluid Type	Olive Oil		
4	Density (ρ)	0.879	[g / cm^3]		Density (ρ)	0.703	[g / cm^3]	
5	Viscosity (μ)	6.47E-03	[g / (cm s)]		Viscosity (μ)	1.01	[g / (cm s)]	
6								
7	Velocity (v)	15	[cm / s]		Velocity (v)	50	[cm / s]	
8								
9	Pipe Diameter	Reynolds Number			Pipe Diameter	Reynolds Number		
10	(D) [cm]	(Re) [--]			(D) [cm]	(Re) [--]		
11	1.27	2,588			1.27	44		
12	2.54	5,176			2.54	88		
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14	5.08	10,352			5.08	177		
15	6.35	12,940			6.35	221		
16	7.62	15,529			7.62	265		

	Expression	Typed into Cell
(a)	= IF(B4 > F4, B3, "F3")	D4
(b)	= IF(B7/2 > F7/10, " ", B7*2)	H7
(c)	= IF(B11 < F11, "B11", IF(B11 > F11, SUM(B11, F11), F11))	D11
(d)	= IF(AND(B4 < F4,B5 < F5), B3, MAX(F11:F16))	D9
(e)	= IF(OR(E16/2^2 > E15*2,E11+E12 < E14),F4*62.4,F4*1000)	H16

ICA 10-11

Write the output value that would appear in a cell if the equation was executed in Excel. You should answer these questions WITHOUT actually using Excel, as practice for the exam. If the cell will appear blank, write "BLANK" in the space provided.

= IF(AND(A1/A2 > 2, A2 > 3), A1, A2)			Output
(a)	A1 = 30	A2 = 5	
(b)	A1 = 5	A2 = 1	

= IF(SIN(A1*B1/180) < 0.5, PI(), IF(SIN(A1*B1/180) > 1, 180/A1,""))			Output
(c)	A1 = 30	B1 = PI()	
(d)	A1 = 5	B1 = PI()	

ICA 10-12

Write the output value that would appear in a cell if the equation were executed in Excel. You should answer these questions WITHOUT actually using Excel, as practice for the exam. If the cell will appear blank, write "BLANK" in the space provided.

= IF(OR(C1 > D3, D3 < E1), "YES", "NO")				Output
(a)	C1 = 10	E1 = −5	D3 = 0.1*C1^(−5*E1)	
(b)	C1 = 10	E1 = 5	D3 = 0.1*C1^(−5*E1)	

= IF(AND(G4/H3 > 2, H3 > 3), G4, MAX(2, G4, H3, 5*J2-10))				Output
(c)	G4 = 30	H3 = 5	J2 = 2	
(d)	G4 = 10	H3 = 8	J2 = 10	

ICA 10-13

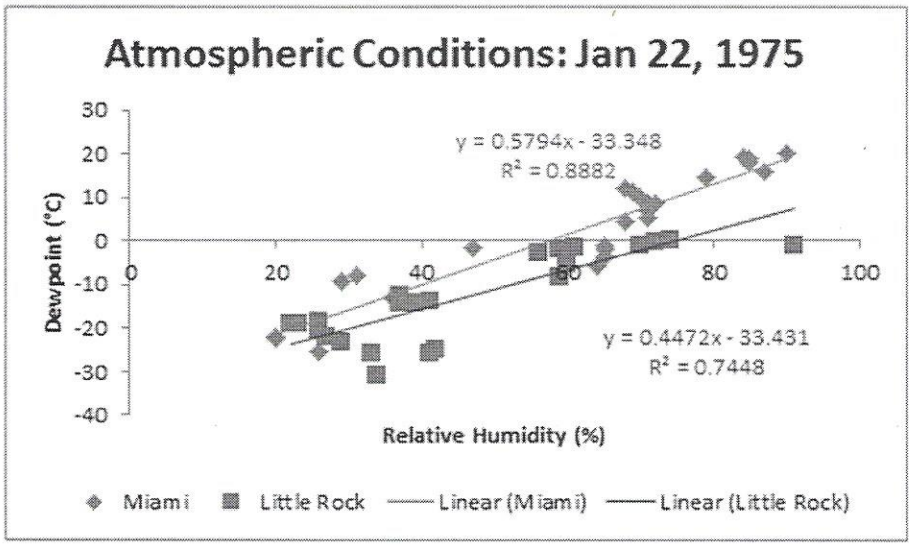
Refer to the following worksheet. In all questions, give the requested answers in Excel notation, indicating EXACTLY what you would type into the cell given to properly execute the required procedures.

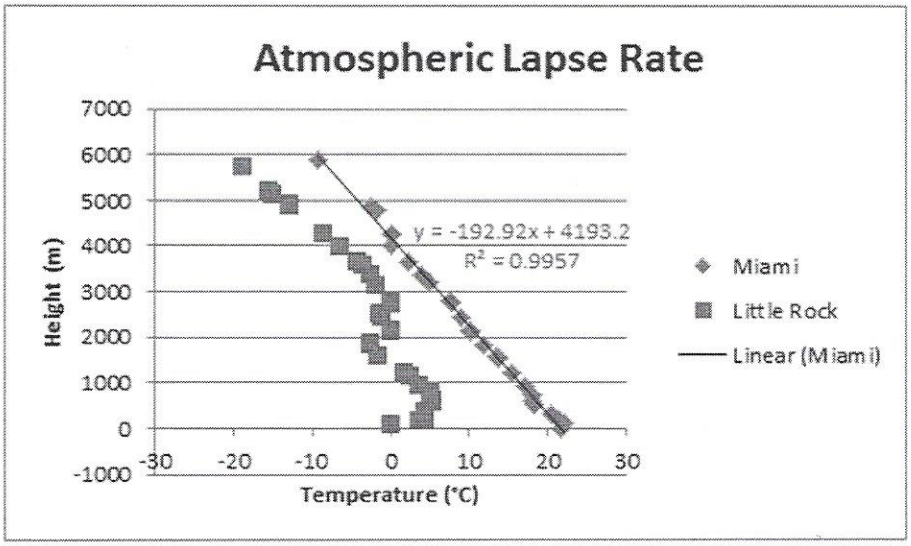
	A	B	C	D	E	F	G
1							
2							
3	Height (H) [ft]	5			Width (W) [ft]		
4					1	1.5	2
5							
6	Volume (V)	Radius (r)	Area (A)		Length [ft]		
7	[ft^3]	[ft]	[ft^2]	[cm^2]	(L1)	(L2)	(L3)
8	79		70.5				
9	1		7.9				
10	55		58.8				
11	13		28.6				
12	39		49.5				
13	9		23.8				
14	63		62.9				
15	23		38.0				
16	72		67.3				
17	27		41.2				
18	67		64.9				

ENGR130 Introduction to Engineering
Homework 4

1. Download the HW4 spreadsheet from E360. It contains atmospheric data provided by the University of Wyoming http://www.weather.uwyo.edu/upperair/sounding.html for many cities across the US. The data is collected from radiosonde instruments at upper levels of the atmosphere (weather balloons or remote sensing). We will focus on 2 cities (Miami, FL and Little Rock, AK) for January 22, 1975.

2. We will focus on changes in air pressure and temperature with height above the ground for the two locations. You will produce the two plots shown below. Create them in your spreadsheet and label them exactly as shown. (See this document posted in E360 for colors.)





Answer the following questions. Write the answer in your spreadsheet under the plots.

1. Compare the relationship between relative humidity and dewpoint for the two cities.
    a. What are the slopes of the trendlines?
    b. What are the intercepts?
    c. What are the R^2 values?
    d. Based on the R^2 values, which dataset exhibits a more linear relationship?

2. Now compare the plots of height vs. temperature for both cities.
    a. Does the temperature increase or decrease with height?

    b. Which city exhibits a linear relationship between height and temperature?

    c. Extra credit: calculate the atmospheric lapse rate for Miami (decrease in temperature per 100 m of height).