

# Basic Engineering Design in Climate and Energy Systems Engineering (38518-01)

## - Answer Sheet for Final Examination -

Student ID:

Name:

### Notice

- This word file is your *answer sheet*. Write your solutions down on this MS-WORD file.
- Below is how to submit (i.e., upload) your answer sheet on Ewha Cyber Campus.
  - 1) Compress your *answer sheet*, MS-EXCEL, and MATLAB solution files into a single \*.zip file. The filename of the ZIP file must be as follows:  
(Final)-(student ID)-(last name)  
**For example, Hyunhee Cho's file name must be Final-1773026-Cho.**
  - 2) Upload the zip file on Ewha Cyber Campus by 12:20 PM on June 14, 2018.
- **NO discussion** is allowed during the examination.
- Fill your name in the following:  
“I, \_\_\_\_\_, swear I solve all problems by myself in this final examination.  
I will take any disadvantages if any dishonesty such as cheating is acted on my solution.”

### **Problem 1.**

Please refer to the report “bp-statistical-review-of-world-energy-2017-underpinning-data.xlsx”. Note that this file was also uploaded on Ewha Cyber Campus on the 2<sup>nd</sup> Week of this lecture.

- 1-1. Using MS-EXCEL, draw a graph of annual natural gas prices for US Henry Hub, Average German Import Price cif, UK NBP, and Japan LNG cif in \$/MMBtu (i.e., US dollars per million Btu) between 1986 and 2016. Plot the data with discrete markers (e.g., square, circle, and diamond), colors (e.g., red, green, and blue), and line types (e.g., solid and dotted). Include a legend of the four natural gases. You have to draw four plots on a single graph [10 pts.].
  
- 1-2. Redraw the 1-2 graph using MATLAB [10 pts.].  
(Tip: use the built-in function “plot” in MATLAB).

**Problem 2.**

Write a MATLAB program to convert a Celsius temperature to Fahrenheit. Test your program using the following data. Fill out the four blanks in the table below [20 pts].

Test No.	Celsius (°C)	Fahrenheit (°F)
1	30	
2	15	
3	0	
4	-40	

**Problem 3.**

Generate a synthetic temperature data set using the MATLAB built-in function “peaks.” In other words,

```
>> Temp = peaks;
```

Write your own MATLAB code that reproduces the graph below [20 pts.]:

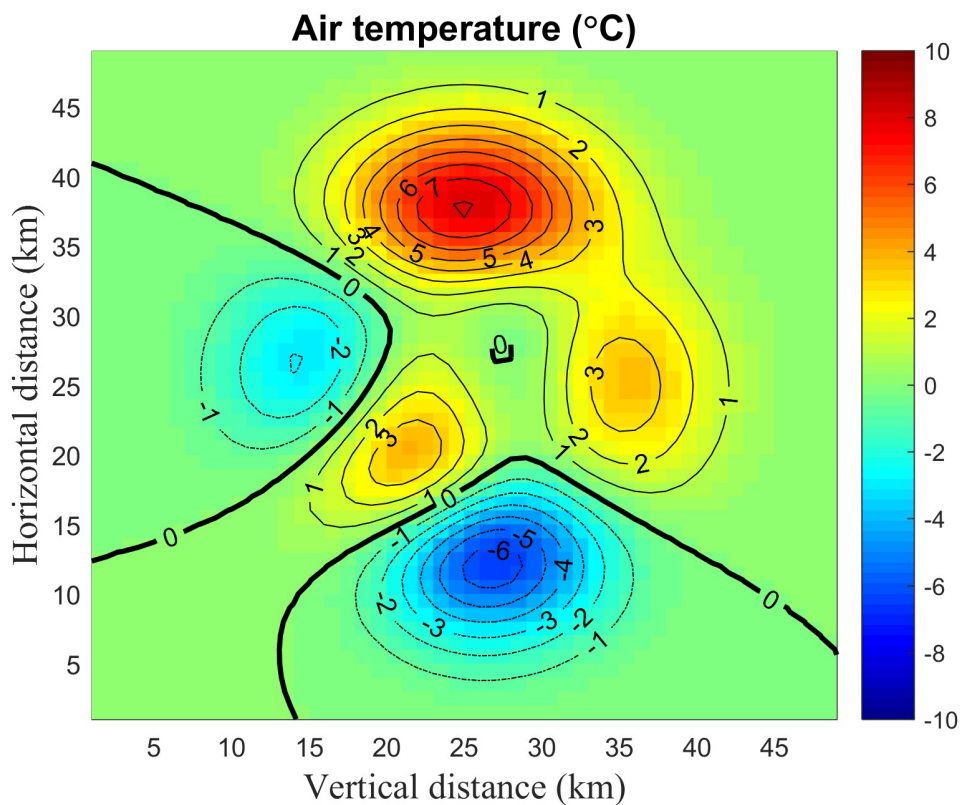
Tip 1. For solving this problem, you can refer to the lecture note “lect11\_graphics.pdf.”

Tip 2. Use the functions *contour* and *pcolor*. The linewidth of the contour for the value of 0 is 4.

Tip 3. Use the function *clabel*.

Tip 4. The font name of x and y labels is ‘Times New Roman,’ and their font size is 14 points.

Tip 5. The font name of figure title is ‘Helvetica,’ and its font size is 14 points.



**Problem 4.**

Write your own MATLAB program that imports “hourly\_temp(90).dat.” This csv file contains air temperature at the area code number 90 from 1981 to 2011.

4-1. Draw a graph of *hourly* air temperature on June 14, 2011 using MATLAB [5 pts.]

**Answer)**

4-2. Calculate the mean, standard deviation, minimum, 1<sup>st</sup> quartile, 2<sup>nd</sup> quartile, 3<sup>rd</sup> quartile, and maximum air temperature in June 2011 [10 pts].

**Answer)**

4-3. Calculate *daily* air temperature on June 14 every year from 1981 to 2011. Then, calculate the mean and standard deviation of those daily air temperature values [10 pts].

**Answer)**

**Problem 5.**

Translate the following formulae into MATLAB expressions: [2 pts per each].

(a)  $\ln ( x + y^2 + z^3 )$

(b)  $[ e^3 t + t \sin (4t) ] \cos^2(3t)$

(c)  $4 \tan^{-1} (1)$

(d)  $\csc^2(x) + \cot (y)$

(e)  $\cot^{-1} ( |x/c| )$

**Problem 6.**

Write your review of your most impressive guest lecture this semester. Include the name of the lecturer and the subject of the lecture in the review. [5 pts].

----- This is the end of Final Examination -----