**ENGR 102**

**Lab and Assignment #1B [100 POINTS]**

Activity #1: Assignment: Writing your own Programs (**Individual**)

You are to write 2 programs, as described below. Be sure that each file contains the appropriate header information.

**Program 1:**

The purpose of this program is to familiarize you with some basic Engineering equations, as well as to have practice writing a simple Python program that performs calculations.

Write a program that outputs each of the following, on subsequent lines. We will ignore units in these equations. **You will likely need to look up some of the formulas for some of these online (it’s fine to do so – that is part of the task!)**. You may discuss where to find information about these equations with other students, but you should actually read the details and write the computations yourself. The actual output should be the result of the calculation. Your code should show the full calculation. For instance, if the task is to print the area of a square with side length 5, you would want to have a line such as:

print(5\*5)

And not the line:

print(25)

You should have 10 lines of output, giving each of the following. If you do not have a result for one of these, print an empty line, or the text “no answer” in that line.

1. Your name, UIN, and section number of ENGR 102 that you are enrolled in
2. A sentence giving some interesting fact about yourself
3. The voltage across a conductor with resistance 20 and a current of 5.
   1. **Ohm’s Law** states that the current through a conductor between two points is directly proportional to the voltage across the two points.
4. The kinetic energy of an object with mass 100 and velocity 21
   1. The **Kinetic Energy** of an object is the energy that it possesses due to its motion. The standard unit of kinetic energy is the joule.
5. The Reynolds number for a fluid with velocity 100 and kinematic viscosity 1.2, with characteristic linear dimension 2.5.
   1. The **Reynolds Number** is an important dimensionless quantity in fluid mechanics that is used predict flow patterns in different fluid flow situations. It is the ratio of inertial forces to viscous forces.
6. The energy radiated per unit surface area (across all wavelengths) for a black body with temperature 2200. Use 5.67 x 10-8 for the Stefan-Boltzmann constant.
   1. The **Stefan-Boltzmann Law** describes the power radiated from a black body in terms of its temperature. Specifically, the total energy radiated per unit surface area of a black body across all wavelengths per unit time is proportional to the fourth power of the black body's thermodynamic temperature
7. The production of a well after 20 days, if it had an initial production rate of 100, an initial decline rate of 2/day, and a hyperbolic constant of 0.8.
   1. **Arps equation** is a mathematical model to forecast future production rates of oil and gas wells.
8. The average length of an M/M/1 queue with an arrival rate of 20 and a service rate of 35.
   1. An **M/M/1 Queue** represents the queue length in a system having a single server, where arrivals are determined by a Poisson process and job service times have an exponential distribution. The model is the most elementary of queueing models.
9. The shear stress when a normal stress of 20 is applied to a material with cohesion 2 and angle of internal friction 35 degrees
   1. The **Mohr-Coulomb Failure Criterion** represents the linear envelope that is obtained from a plot of the shear strength of a material versus the applied normal stress. More generally, the Mohr–Coulomb theory is a mathematical model that describes the response of brittle materials, like concrete or rubble piles, to shear stress as well as normal stress. Most of the classical engineering materials somehow follow this rule in at least a portion of their shear failure envelope.
10. The scattering angle for maximum interference for light of wavelength 7.5 x 10-7 hitting a crystalline lattice with planes separated by a distance 1 x 10-6.
    1. **Bragg’s Law** is a relationship describing the angles for coherent and incoherent scattering from a crystal lattice. Specifically, it describes the condition for maximum constructive interference.

**‘a’ to ‘j’ 🡪 10 \*10 = 100**