Name:_____ Instructor:_____ ENGR 121 - Exam 2
Section:_____ November 14, 2017

Allowed Materials: *F.E. approved calculator(s) see syllabus; pencils and/or pens.*

ExamForm := 11

Honor Statement: *On my honor, I promise that I have not received any unauthorized assistance on this exam (I didn't look at another student's paper, I didn't view any unauthorized written materials, I didn't talk or listen to another student, I didn't use an unauthorized calculator, I didn't use any electronic device, any visual or auditory signals, or any other techniques of exchanging information with others.) I have maintained the highest standards of academic integrity while completing this exam.*

*Signed:*_____

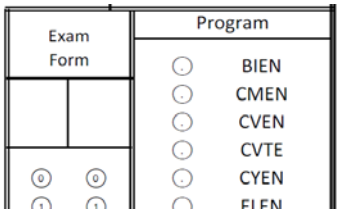
---

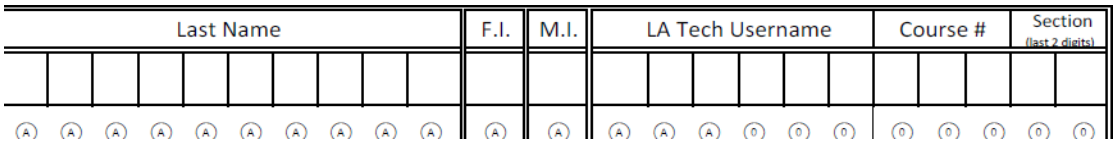
1. *(2 point deduction for failure to complete this problem!)*

Bubble:	For Course Section:	
01	001 - Corbett	TR 10-11:50
02	002 - Reis	TR 4-5:50

- Write in all of the indicated information in the boxes of your response form.
- Darken the appropriate circles to encode the corresponding information.
- Write your name on this exam and sign the Honor Statement.

Notes:
- If your last name is too long, just write the first 10 letters.
- "**F.I.**" and "**M.I.**" are your first and middle initials, respectively
- Your **"Username"** is the first part of your LATech email address
- For **"Section"** use the guide provided to the right
- Your **"Exam Form"** is printed on the upper right corner of this page.
- Indicate "ENGR" as the **"Program"**





$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"I properly completed all required items in problem 1, so I will not lose these points"} \\ \text{"B"} & \text{"I did not properly complete problem 1 because I am fine with losing these points."} \end{pmatrix}$$

---

2. (3 points) _____ is the difference between the upper control limit and the lower control limit of the fishtank system.

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"setpoint"} \\ \text{"B"} & \text{"material balance"} \\ \text{"C"} & \text{"deadband"} \\ \text{"D"} & \text{"error"} \\ \text{"E"} & \text{"gain"} \\ \text{"F"} & \text{"hysteresis"} \\ \text{"G"} & \text{"difference band"} \\ \text{"H"} & \text{"deadtime compensation"} \end{pmatrix}$$

---

3. (3 points) The chemical reaction 1 is inert, and the chemical reaction 2 is active. Which reaction is more likely to occur?

Chemical Reaction 1: $Li^{-1}\,(aq) + e^{-} \rightarrow Li\,(s)$

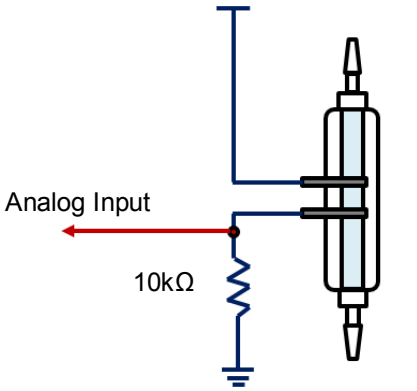
Chemical Reaction 2: $H_2O_2\,(aq) + 2H^{+} + 2e^{-} \rightarrow 2H_2O\,(l)$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"Chemical Reaction 1"} \\ \text{"B"} & \text{"Chemical Reaction 2"} \\ \text{"C"} & \text{"neither of these reactions will occur"} \\ \text{"D"} & \text{"Not enough information"} \\ \text{"E"} & \text{"They will both occur spontaneously"} \end{pmatrix}$$

4. (3 points) If the voltage across the conductivity sensor probes _____, then the voltage drop across the 10kΩ resistor _____.

Choices =

"A"	"increases, increases"
"B"	"decreases, increases"
"C"	"increases, stays the same"
"D"	"stays the same, increases"
"E"	"stays the same, decreases"
"F"	"decreases, stays the same"
"G"	"decreases, decreases"
"H"	"not enough information"



5. (3 points) Deionized water is used for the fishtanks instead of tap water because:

Choices =

"A"	"deionized water tastes better"
"B"	"tap water does not flow through the system as easily"
"C"	"tap water contains dissovled ions"
"D"	"deionized water contains more ions"
"E"	"deionized water provides a clearer color"
"F"	"tap water causes corrosion in the fistank tubes"
"G"	"tap water does not contain any impurities"
"H"	"deionized water is rich in sodium and calcium"

6. (3 points) Which of the following are reasons calibration was used for the conductivity sensor?

I. Associate sensor output with salt concentration
II. Be able to compute the salt concentration based on sensor output
III. Be able to compute volume based on output
IV. Associate sensor output with flow rate
V. Relate sensor output and salt concentration
VI. Associate salt concentration with flow rate

Choices =

"A"	"III, IV, & VI"
"B"	"IV & VI"
"C"	"I, II, & V"
"D"	"II only"
"E"	"I, II, & VI"
"F"	"I, V & IV"
"G"	"I only"
"H"	"I & III"

7. (3 points) When operating your conductivity sensor, more ions at the anode will:

Choices =

"A"	"increase the voltage at the electrodes"
"B"	"decrease the voltage at the electrodes"
"C"	"increase the rate at which chemical reaction occur"
"D"	"cause the electrodes to corrode"
"E"	"cause a higher resistance"
"F"	"cause less ions at the cathode"
"G"	"cause the electrodes to heat up"
"H"	"decrease the rate at which chemical reactions occur"

8. (3 points) You decide to make homemade ice cream at a picnic. You get a bucket, add all of the ingredients for the ice cream, and churn the mixture for 30min. After that time, you are ready to serve your ice cream. This process is an example of:

Choices =

"A"	"generated system components"
"B"	"a non steady state rate system"
"C"	"a steady state rate system"
"D"	"a batch system"
"E"	"consumed system components"
"F"	"conservation of energy"
"G"	"a flow system"
"H"	"I don't know, but I hope the flavor is strawberry"

9. (3 points) You are evaluating the temperature control on your fish tank. The first temperature reading displays a temperature greater than the UCL. The very next temperature reading displays a value between your LCL and setpoint. According to the procedure discussed in class notes, what should your heater do?

Choices =

"A"	"STAY OFF until temperature is below LCL"
"B"	"TURN ON until temperature reaches UCL"
"C"	"TURN OFF until temperature reaches LCL"
"D"	"STAY ON until temperature reaches UCL"
"E"	"STAY ON until temperature reaches LCL"
"F"	"STAY ON until temperature reaches LCL"
"G"	"not enough information"

10. (3 points) The schematic shown represents a _____ relay.

Choices =

"A"	"Triple Pole Triple Throw"
"B"	"Single Pole Single Throw"
"C"	"Triple Pole Double Throw"
"D"	"Single Pole Double Throw"
"E"	"Double Pole Single Throw"
"F"	"Quadruple Pole Quadruple Throw"
"G"	"Quadruple Pole Double Throw"
"H"	"Double Pole Double Throw"

11. (3 points) In order to allow the fish tank system to come to an equilibrium before responding to error _____ is set.

Choices =

"A"	"setpoint"
"B"	"gain"
"C"	"lower control limit"
"D"	"deadtime compenstation"
"E"	"error"
"F"	"target concentration"
"G"	"deadband"
"H"	"upper control limit"

12. (5 points) You are making some candy that requires you to heat $\text{sugar} = 310 \cdot \text{gram}$ to a specific temperature, $T_2 = 112\ °C$. The sugar is in a saucepan on a stovetop burner that produces 3000Watts of power. You measure the sugar and it is currently at $T_1 = 101\ °C$. If the specific heat of sugar is 2763 J/(kg °C), then the time you will need to leave the sugar in the pan in order to reach the desired temperature is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 2.759 \\ \text{"B"} & 2.949 \\ \text{"C"} & 3.141 \\ \text{"D"} & 3.332 \\ \text{"E"} & 3.522 \\ \text{"F"} & 3.714 \\ \text{"G"} & 3.906 \\ \text{"H"} & 4.093 \\ \text{"I"} & 4.285 \\ \text{"J"} & 4.482 \end{pmatrix} \text{ s}$$

13. (5 points) A chamber of water with a $\text{diameter} = 1.2\text{m}$ and a $\text{depth} = 0.5\text{m}$ is heated by a $\text{Resistor} = 18\Omega$ which is powered by a 12VDC power supply. If the heaters are on for a $\text{time} = 175 \cdot \text{min}$, then the number of heaters needed to increases the water temperature from the intiial temperature (T_1) to the final temperature (T_2) given below is closest to:

$T_1 = 20\ °C \qquad T_2 = 24\ °C$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 99 \\ \text{"B"} & 106 \\ \text{"C"} & 113 \\ \text{"D"} & 120 \\ \text{"E"} & 127 \\ \text{"F"} & 134 \\ \text{"G"} & 140 \\ \text{"H"} & 147 \\ \text{"I"} & 154 \\ \text{"J"} & 161 \end{pmatrix}$$

14. (5 points) Assume the setpoint for your salinity control system is 0.11 wt% NaCl, the UCL is 0.13 wt% NaCl, and the LCL is 0.09 wt% NaCl. Assuming the current salinity is 0.20 wt% NaCl and you operate your control system with a gain factor as shown below, the target salinity is closest to:

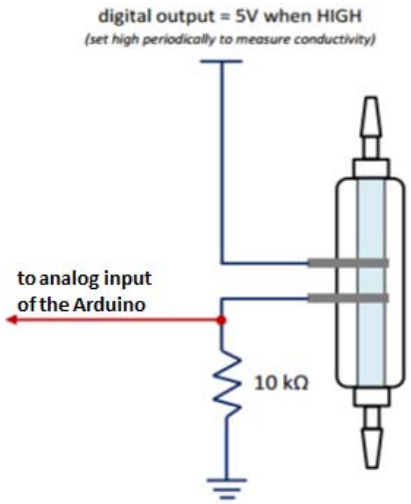
$\text{Gain} = 0.6$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.092850 \\ \text{"B"} & 0.101672 \\ \text{"C"} & 0.110525 \\ \text{"D"} & 0.119395 \\ \text{"E"} & 0.128332 \\ \text{"F"} & 0.137162 \\ \text{"G"} & 0.146000 \\ \text{"H"} & 0.154863 \end{pmatrix} \cdot \%$$

15. (5 points) The Lady of The Mist fountain initially contains a $\text{volume} = 3000\,\text{L}$ of water. As a prank a student replaces all of this water with DI water from the lab. Overcome with remorse, the student then decides to make the fountain into a salt water fish tank. The student decides to $\text{add} = 1000\,\text{L}$ of 10%wt salt water. Assuming salt concentration does not affect water density, the ending salt concentration is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 1.890 \\ \text{"B"} & 2.043 \\ \text{"C"} & 2.197 \\ \text{"D"} & 2.348 \\ \text{"E"} & 2.500 \\ \text{"F"} & 2.651 \\ \text{"G"} & 2.803 \\ \text{"H"} & 2.957 \\ \text{"I"} & 3.109 \\ \text{"J"} & 3.259 \end{pmatrix} \cdot \%$$

16. (5 points) You are sensing conductivity using the circuit shown. The analogRead function in your Arduino returns a $\text{value} = 437$. The power being dissipated in the 10kΩ resisitor is closest to:



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.4007 \\ \text{"B"} & 0.4286 \\ \text{"C"} & 0.4562 \\ \text{"D"} & 0.4839 \\ \text{"E"} & 0.5117 \\ \text{"F"} & 0.5391 \\ \text{"G"} & 0.5668 \\ \text{"H"} & 0.5944 \\ \text{"I"} & 0.6227 \\ \text{"J"} & 0.6505 \end{pmatrix} \cdot \text{mW}$$

17. (5 points) By a once-in-a-lifetime chance, you have gotten an internship at *Do Something Jurassic*, the newest dinosaur theme park. One of your responsibilites is to maintain the salt water tank where the Pilosaurus food is kept. The fish in the aquarium require salt water that is 0.08% NaCl by weight. The tank $\text{contains} = 1600 \cdot \text{in}^3$ of DI water already. The amount of salt you would need to add to have the correct salinity for the fish is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 13.35 \\ \text{"B"} & 14.62 \\ \text{"C"} & 15.89 \\ \text{"D"} & 17.16 \\ \text{"E"} & 18.45 \\ \text{"F"} & 19.72 \\ \text{"G"} & 20.99 \\ \text{"H"} & 22.27 \\ \text{"I"} & 23.54 \\ \text{"J"} & 24.81 \end{pmatrix} \cdot \text{grams}$$

18. (5 points) Mined coal contains a component of sulfur that is an environmental concern when burned, and a component of ash that is not of value toward energy production. A mechanical process can be used to clean mined coal to decrease the amounts of these undesirable components and produce "clean" coal. The process involves introducing a mined coal feedstock that $\text{contains} = 69 \cdot \%$ combustible coal,13% ash, 12% sulfur, $\text{and} = 6 \cdot \%$ water into the apparatus. The cleaned coal coming out of the process $\text{contains} = 84 \cdot \%$ combustible coal, $\text{and} = 6 \cdot \%$ sulfur, with the remainder of the cleaned coal product composed of water and ash. The waste product contains 35% sulfur and 10% water, with the remainder of the waste composed of combustible coal and ash. The steady-state process $\text{produces} = 2 \cdot \frac{\text{tons}}{\text{hr}}$ of cleaned coal. The rate at which the feedstock of mined coal must be introduced into the process is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 2.37 \\ \text{"B"} & 2.52 \\ \text{"C"} & 2.68 \\ \text{"D"} & 2.83 \\ \text{"E"} & 2.98 \\ \text{"F"} & 3.13 \\ \text{"G"} & 3.29 \\ \text{"H"} & 3.44 \\ \text{"I"} & 3.60 \\ \text{"J"} & 3.75 \end{pmatrix} \cdot \frac{\text{tons}}{\text{hr}}$$

19. (5 points) Assume that $\text{electrons} = 5.26 \times 10^{21}$ pass through the anode of a conductivity sensor over $\text{time} = 11\,\text{min}$. The electrical current thought the anode is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 1.044 \\ \text{"B"} & 1.121 \\ \text{"C"} & 1.199 \\ \text{"D"} & 1.277 \\ \text{"E"} & 1.355 \\ \text{"F"} & 1.432 \\ \text{"G"} & 1.510 \\ \text{"H"} & 1.589 \\ \text{"I"} & 1.664 \\ \text{"J"} & 1.742 \end{pmatrix} \cdot \text{A}$$

20. (5 points) The number of H_2 molecules produced over 3 minutes given the following constant current though the conductivity sensor is closest to:

$\text{Constant\_Current} = 11\,\text{A}$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 5.053 \\ \text{"B"} & 5.429 \\ \text{"C"} & 5.802 \\ \text{"D"} & 6.178 \\ \text{"E"} & 6.552 \\ \text{"F"} & 6.926 \\ \text{"G"} & 7.304 \\ \text{"H"} & 7.680 \end{pmatrix} \cdot 10^{21}$$

21. (5 points) You would like to cool down your tea which is has an initial temperature, $T1_{tea} = 185\ \text{°C}$ and a mass given below. You will add honey that is initally at a temperature $T1_{honey} = 24\ \text{°C}$. Given the desired drinking temperature and the specific heat values of honey and tea below, the mass of honey to be added to the tea is closest to:

$C_{phoney} := 2259.36 \dfrac{\text{J}}{\text{kg}\cdot\text{°C}}$

$C_{ptea} := 4180 \dfrac{\text{J}}{\text{kg}\cdot\text{°C}}$

$\text{Drinking}_{Temp} = 180\ \text{°C}$

$\text{Tea} = 6.6\cdot\text{oz}$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.249 \\ \text{"B"} & 0.272 \\ \text{"C"} & 0.296 \\ \text{"D"} & 0.320 \\ \text{"E"} & 0.344 \\ \text{"F"} & 0.368 \\ \text{"G"} & 0.391 \\ \text{"H"} & 0.415 \\ \text{"I"} & 0.439 \\ \text{"J"} & 0.463 \end{pmatrix} \cdot \text{oz}$$

22. (5 points) Dr. Hall is making a batch of his famous possum gumbo. After tasting his 3.81 kg of roux, he determines that it is too salty at the given initial NaCl % (he has very sensitive taste buds). How much water does Dr. Hall have to add to his roux to bring the NaCl % to the given ideal percentage? **Assume roux and water have the same density.**

$\text{Initial\_NaCl\_Percentage} = 0.13\ \%$

$\text{Ideal\_NaCl\_Percentage} = 0.04\ \%$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 7.535 \\ \text{"B"} & 8.050 \\ \text{"C"} & 8.572 \\ \text{"D"} & 9.093 \\ \text{"E"} & 9.618 \\ \text{"F"} & 10.138 \\ \text{"G"} & 10.663 \\ \text{"H"} & 11.168 \end{pmatrix} \text{kg}$$

23. (5 points) Assume the depth of salt water in a fishtank is 1.5 inches (recall that the inside diameter of the tank was 1.6 inches). If the water has a salt $\text{concentration} = 0.07 \cdot \%$ wt NaCl, compute the final salt water concentration after a $\text{volume} = 1.7 \cdot \text{cm}^3$ of water with 1.3% wt NaCl is added to the fishtank. Assume the same amount of water that you add also leaves the through the overflow, where 77% of the water leaving is $\text{concentration} = 0.07 \cdot \%$ wt NaCl and 23% of the water leaving is 1.3% wt NaCl.

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.0776 \\ \text{"B"} & 0.0839 \\ \text{"C"} & 0.0901 \\ \text{"D"} & 0.0964 \\ \text{"E"} & 0.1026 \\ \text{"F"} & 0.1088 \\ \text{"G"} & 0.1151 \\ \text{"H"} & 0.1213 \end{pmatrix} \cdot \%$$

24. (5 points) Assume you have a $\text{mass} = 105 \cdot \text{grams}$ of a salt water mixture that is 10% NaCl. You decide to mix in a certain amount of a 5% NaCl mixture and a certain amount of a 1% NaCl mixture. To result in a total mixture that is 200g and 7% NaCl, the amount of the 1% mixture you must add is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 21.83 \\ \text{"B"} & 26.54 \\ \text{"C"} & 31.25 \\ \text{"D"} & 35.95 \\ \text{"E"} & 40.66 \\ \text{"F"} & 45.38 \\ \text{"G"} & 50.10 \\ \text{"H"} & 54.84 \\ \text{"I"} & 59.50 \\ \text{"J"} & 64.23 \end{pmatrix} \cdot \text{grams}$$

25. (5 points) After finishing ENGR 121, you decided to make a scaled-up fish tank capable of measuring and controlling the salinity of the water. Your fish tank can hold 30 liters of salt water in addition to the fish and decorations. You even included a conductivity sensor, an overflow drain line, as well as a separate tank of DI water to help control the salinity. Under normal circumstances, your system gradually supplies DI water to account for the evaporation of water over time. One day, however, your roommate, when trying to feed the fish used a salt shaker that was nearby instead of the fish food (because the containers look so much alike). The new salinity reading after the salt was added is $\text{salinity}_{\text{new}} = 4.1 \cdot \%$. Your fish tank is programmed to maintain the salinity at 3.5% weight by salt. The pump for DI water pumps water at a $\text{rate} = 0.31 \cdot \frac{\text{L}}{\text{min}}$ into the top of the tank. The amount of time the pump will have to stay on to bring the water in the tank back to its original salinity reading of 3.5% is closest to...

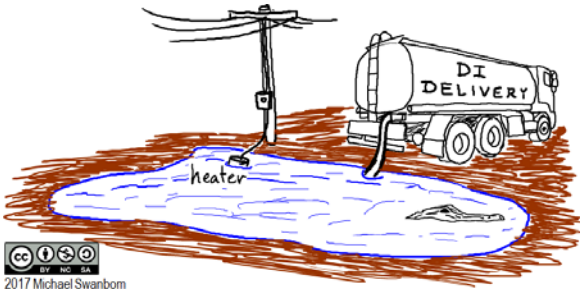
Assumptions

- Assume the density of the DI water and the salt water regardless of the salinity is 1 kg/L.
- Assume the overflow fraction is 15% (that is 15% of the newly added DI water will spill over into the drain; the remainder percentage is composed of the original salty water before the DI water was added)
- Assume that the amount of salt initially added does not cause any overflow.

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 15.99 \\ \text{"B"} & 16.66 \\ \text{"C"} & 17.34 \\ \text{"D"} & 18.02 \\ \text{"E"} & 18.69 \\ \text{"F"} & 19.38 \\ \text{"G"} & 20.07 \\ \text{"H"} & 20.72 \\ \text{"I"} & 21.40 \\ \text{"J"} & 22.11 \end{pmatrix} \cdot \text{min}$$

26. (5 points) Dr. Scoggin tripped and spilled the backpack full of sodium chloride crystals he normally carries into his heated alligator pond, where his beloved pet Terrabite lives. Dr. Scoggin would do anything for Terrabite, so he immediately calls his usual deionized water delivery service to come help him restore Terrabite's preferred salt concentration $= 1.6 \cdot \%$. When he arrives, the DI guy uses a conductivity sensor and measures the salt concentration to be $= 1.64 \cdot \%$ and proceeds to pump the correct amount of DI into the pond to bring the concentration back to Terrabite's preferred salt concentration. Prior to pumping the DI water, the aquatic salt water habitat occupied a volume of 13 cubic meter (m^3). As Dr. Scoggin watches, he realizes that the chilly 12 ºC water being added is making his sweet Terrabite cold, since she is used to living in water kept at $= 30 \cdot °C$ by the $= 1850 \cdot$ Watt electric heater installed in her pond.He is able to turn the heater on after the DI water is pumped into the aquatic habitat. Assuming zero heat loss from the pond and that the temperature of the pond before the DI water was added was at the desired temperature, the amount of time that Dr. Scoggin will have to fret about Terrabite before the heater has corrected the pond's temperature is closest to:

Note: Assume all water, regardless of salt concentration, has the density and specific heat capacity of DI water.



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 2.55 \\ \text{"B"} & 2.78 \\ \text{"C"} & 3.00 \\ \text{"D"} & 3.22 \\ \text{"E"} & 3.45 \\ \text{"F"} & 3.67 \\ \text{"G"} & 3.89 \\ \text{"H"} & 4.12 \\ \text{"I"} & 4.34 \end{pmatrix} \cdot \text{hr}$$

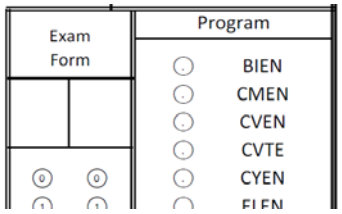
While you are waiting to begin your test:

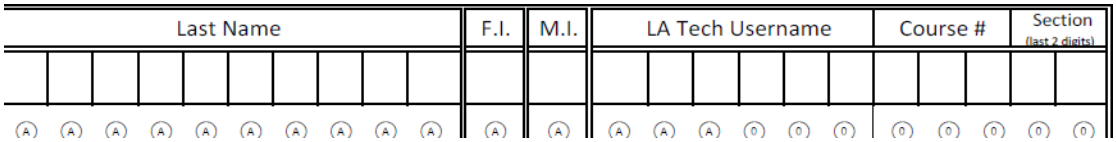
Bubble:	For Course Section:	
01	001 - Corbett	TR 10-11:50
02	002 - Reis	TR 4-5:50

- Please write and bubble your name and initials on your response sheet
- Please write and bubble your LATech username (e.g. abc567) on your response sheet
- Please write and bubble your section number on your response sheet using the guide shown here
- Please write and bubble your ExamForm number. This is your ExamForm:

ExamForm= 11

Notes:
- If your last name is too long, just write the first 10 letters.
- "**F.I.**" and "**M.I.**" are your first and middle initials, respectively
- Your "**Username**" is the first part of your LATech email address
- For "**Section**" use the guide provided to the right
- Indicate "ENGR" as the "**Program**"





Also Note:

- Mobile phones or other electronic devices (other than FE-approved calculators and plain timepieces) are not allowed on this exam. If you have non-approved devices including smartwatches, please deposit them at the front of the room for the duration of the exam. Don't forget to retrieve them when you prepare to depart.
- Please deposit any bags you might have brought in the front of the room for the duration of the exam.
- Please note the reference information given below.
- If you need additional scratch paper, please ask your proctor. Turn in any scratch paper with your exam, even if unused.
- If you have questions during the exam, please remain in your seat and raise your hand. A proctor will come to you.
- Please use a restroom now if you need it so as to minimize potential disruptions during the exam.

1 coulomb = $6.24(10)^{18}$ electrons Avogadro's Number: $6.022(10)^{23}$

Density of water at 4°C (maximum density) = 1 g/mL = 1g/cm³ = 1000 kg/m³ = 8.33 lbs/gal

$C_{p\,H_2O} = 4180\frac{J}{kg \cdot C}$ $1ton = 2000lb$

1L = 0.001m³ = 1.0567quarts = 0.264gal = 61.02in³ 1 gal = 0.1337 ft³ = 3.785 L

1 pound = 16 ounces = 453.592 grams 1 inch = 25.4 mm 1 foot = 12 inches

Conductivity Sensor Reactions:

$2Cl^-_{(aq)} \longrightarrow Cl_{2\,(g)} + 2e^-$ and $2H_20_{(l)} + 2e^- \longrightarrow H_{2\,(g)} + 2OH^-_{(aq)}$

Atomic Weights:

Na = 23.0 g/mol Cl = 35.5 g/mol C = 12.0 g/mol H = 1.0 g/mol O = 16.0 g/mol

$R = \frac{\rho \cdot L}{A}$ $\alpha = \frac{R_2 - R_1}{R_1(T_2 - T_1)}$ $V \cdot I \cdot t = \rho \cdot Vol \cdot C_p \cdot \Delta T$

Volume of Cylinder = $\frac{\pi \cdot diameter^2}{4} \cdot height$ $\Delta E = Q - W$

172 ENGR121 E1

ExamForm = 11 ind = 1

Key =

	1
1	"A"
2	"C"
3	"B"
4	"B"
5	"C"
6	"C"
7	"C"
8	"D"
9	"A"
10	"E"
11	"D"
12	"C"
13	"C"
14	"G"
15	"E"
16	"C"
17	"G"
18	"B"
19	"D"
20	"D"
21	"G"
22	"C"
23	"E"
24	"C"
25	"B"
26	"F"
27	