**CMGT 235 – Electrical and Mechanical Systems**

Department of Construction Management 🏵 California State University, Chico

Exam #1 [100 points]

**You may work together as a group or individually.**

**Every student SHALL complete their own answer sheet. Use your own paper.**

**Keep all answers in the same numerical order as the exam.**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| 15 pts10 pts15 pts10 pts10 pts20 pts10 pts10 pts | 1. How much energy must be removed to turn a two-gallon jug filled with water from a faucet that is at 50°F into ice at -15°F?
2. How much heat is required to heat a 1 ft3 block of aluminum from 50°F to 105°F?

For the same amount of heat energy and temperature conditions what volume (ft3) of steel is required?1. A 3000 ft2 building has an annual heating requirement of 30,000 Btu/ft2/yr. Compare the cost of heating by propane at $2.00/gallon in an 85% efficient furnace versus heating by an 100% efficient electric furnace at $0.06/kWh.
2. A wall is constructed as follows:

4ʺ face brick1ʺ air spaceNominal 1ʺ foil-faced polyisocyanurate sheathing2 x 4 wood studs 16ʺon center with R13 batt insulation1/2ʺ drywall1. If the wall is 80% insulated area, 20% framed area, what will be the U-factor of the wall?
2. What is the heat load for a wall 8 ft high by 200 ft long if the outside temperature is 42°F and the inside temperature is 78°F using this construction?
3. An LED lamp produces 800 lumens and uses 8W. An incandescent lamp produces 800 lumens and uses 60W.
4. Determine the BTUs per hour for each lamp.
5. If both lamps are on for 12 hours, determine the total amount of heat produced by each lamp.
6. Complete the following:
7. What size (kw) electric heater is required to heat a space from 60°F DB to 80°F DB, assuming the electric heater has a 1000 CFM blower?
8. If the initial RH is 60%, use a psychrometric chart to determine the final RH.
9. What is the change in enthalpy (∆ enthalpy, Btu)?
10. Using the formula, Heat Load = 4.45 x CFM x (∆ enthalpy, Btu), calculate the heat load and compare your result to the solution in A.
11. Estimate infiltration and ventilation air quantities for a 2900 sq. ft. movie theater. The conditioned space has an average height of 20 feet, and the theater seats 200 people. The ACH = 8.0. The required ventilation per person is 20 CFM. Inside temperature is 72°F outside temperature is 48°F.
12. For a 3.5-ton 8ʺ air conditioner supply duct, use the Residential Duct Sizing Chart (attached) to determine:
13. The rectangular duct height size (inches) required
14. The equivalent round duct size (inches) required
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**Residential Duct Sizing Chart**

