

Name: _____

Recitation Section: **L** _____

Student Number: _____

1. Check that your exam includes all 6 pages (cover, 5 problems). Additionally, there is a 2-sided formula sheet.
2. Read all instructions and problems carefully. Points will be deducted for failure to follow instructions.
3. Complete the information requested in the spaces above.
4. PRINT your name and student number in the spaces at the top of all remaining pages of this exam.
5. **Show ALL of your work on these pages.** The pages in this exam may be separated for grading; therefore, if you need extra space for a particular problem, write on the back of the page for that problem. The instructions for a specific question may limit the amount of space allowed for an answer.
6. You are permitted one sheet (8 1/2 x 11, double-sided) of **handwritten** notes. Use of any other notes, books, or other resources is prohibited.
7. Calculators are permitted; however, you are not allowed to use the calculator memory to store notes, etc.
8. This exam lasts for 65 minutes. Point values are listed for each problem to assist you in best using your time.

_____	Problem 1.	(22 points possible)
_____	Problem 2.	(20 points possible)
_____	Problem 3.	(18 points possible)
_____	Problem 4.	(22 points possible)
_____	Problem 5	(18) points possible)
_____	TOTAL.	(100 points possible)

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Problem 1. (22 points)

For each of the following economic computations, (a) list the conversion factor(s) to be used, specifying the parameter values, and (b) compute the result, showing your work. Write your answers on the blank lines on the right edge of this page; correct answers in other locations may not receive full credit. An example is provided.

EXAMPLE:

If you invest \$100 in a bank account today, at an interest rate of 6.5%,
how much will you have after five years? (a) (F/P, 6.5%, 5)

$$100 * (F/P, 6.5%, 5) = 100 * (1 + 0.065)^5 = 100 * 1.3701 = 137.01$$

(b) \$ 137.01

A. (6 points) A company purchases a piece of equipment by writing a check for \$25,000. Assuming that a compound rate of interest of 6% is appropriate, determine the equivalent annualized cost of the equipment, assuming that, after 10 years, the equipment will be worthless. There are no other associated costs. (a) _____
(b) _____

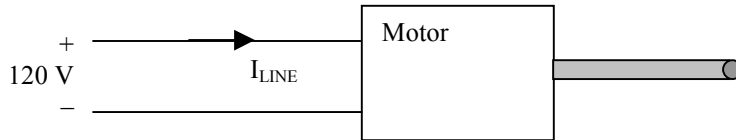
B. (6 points) How much does an individual need to deposit semiannually (every six months) into a savings account in order to be able to purchase a \$30,000 boat at the end of 8 years, assuming that her funds grow compounded at a nominal rate of 10% per year? (The bank calculates interest semiannually.) (a) _____
(b) _____

C. (10 points) An individual wishes to purchase a new piece of machinery by making four annual payments, such that each of the last two payments is twice the amount of each of the first two payments. Determine the economic fair value of the first payment, if the item has a present advertised price of \$4,000, and assuming an interest rate of 8%. (a) _____

NOTE: This problem may require the use of more than one conversion factor. List all factors used. (b) _____

Problem 2. (20 points)

For this problem an interest rate of 5% is appropriate. The single phase motor operates at constant efficiency of 80% and the rms value of line voltage is 110 volts. The motor operates initially at a power factor of .6 lagging and an output power of 8 KW. The purchase cost of the motor is \$10,000.



- A. (7 points) Determine the cost of power for one year for the motor, assuming that it operates 300 days per year, 12 hours per day, and at a cost of power of \$.08 per KW-hr.

Cost = _____

- B. (7 points) Assume that the first year cost of maintenance for the motor is \$400 and that the maintenance cost increases by \$50 per year. Determine the present value of the cost of maintenance for the motor, assuming an 8 year operation.

Cost = _____

- C. (6 points) In recitation #3, the engineering economy problem posed involved a trade-off offered by the power company of rate charged versus power factor.

(i) Why might the power company want to offer this trade-off? Give a specific reason.

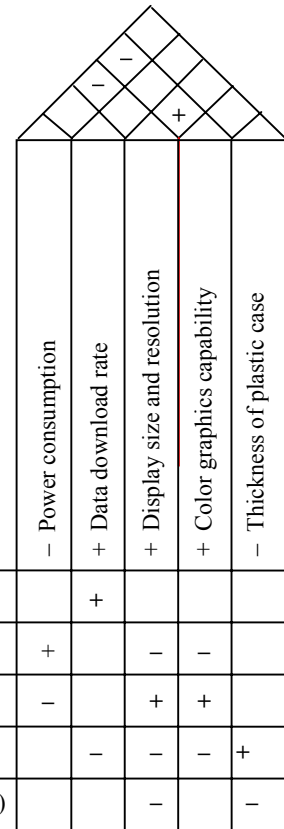
(ii) Why might the manufacturing plant operator might not want to change the power factor of the motor?
Give a specific reason.

(i) _____

(ii) _____

Problem 3. (18 points)

This QFD diagram maps customer desires into engineering characteristics for a battery-powered electronic book reader. This electronic book reader would allow someone to choose and download a book from an on-line selection. The diagram was developed to assist in establishing requirements and specifications for a new product intended for use by vacationers on cruise ships.



In the space below, or on the back of *this page*, answer the following questions.

- A. (6 points) Which **one** of the engineering characteristics listed is likely to have the greatest affect on successful implementation of this product?

- B. (4 points) Which one of the following pairs of customer desires is in conflict?

- (a) Wireless access and long battery life
- (b) Long battery life and low price
- (c) Wireless access and durability
- (d) High quality image and low price

- C. (4 points) Given its interactions with other engineering characteristics, which engineering characteristic is likely to be most difficult to achieve?

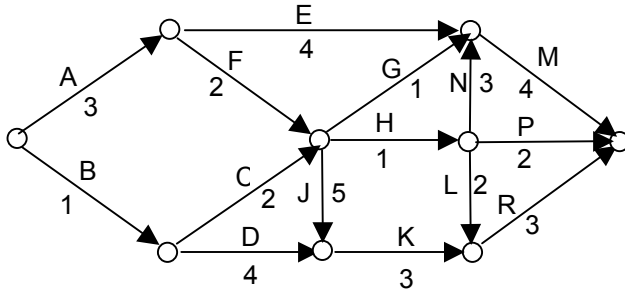
- (a) Power consumption
- (b) Data download rate
- (c) Display size and resolution
- (d) Color graphics capability
- (e) Thickness of plastic case

- D. (4 points) Which one of the following customer desires is likely to be most difficult to achieve?

- (a) Wireless selection access
- (b) Long battery life
- (c) High quality image
- (d) Durability

Problem 4. (22 points)

- A. (6 points) Determine the critical path for the following CPM chart. State the path in terms of activity letters in order from start to finish. Example: AEM



Critical Path _____

- B. (6 points) Determine the float for

(i) Activity E

Float B = _____

(ii) Activity F

Float D = _____

- C. (4 points) Assume now that the above chart is also a PERT chart and that activity M is characterized by

Shortest time = 2.6

Most likely time = 3.8

Longest time = 5.2

Determine the expected time for activity M

Expected time = _____

- D. (6 points) Assume that, for a slightly different PERT chart, the project duration is 17 months and the standard deviation is 3 months. Determine the probability that the project will require greater than 21 months to complete.

Probability = _____

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Problem 5. (18 points)

For each of the sentence pairs below, select the sentence (#1 or #2) that is **incorrect**, by either word usage or content (do not consider spelling or punctuation).

- A. #1 A fundamental problem with design for recyclability is that technology changes may render the modular components obsolete..
- #2 A fundamental problem with design for recyclability is the expense in separating mixed materials.
- B. #1 There were less students than usual in the class after the holiday.
- #2 Atlanta and Macon are less than 100 miles apart.
- C. #1 In the design process, one of the major advantages of prototype development is that theoretically unforeseen component interactions may be uncovered.
- #2 In the design process, one of the major disadvantages of prototype development is that the design must be hierarchical in nature.
- D. #1 In the design process, one of the major advantages of partitioning is the ability to work on multiple tasks in parallel, leading to shorter calendar time to completion
- #2 In the design process, one of the major advantages of partitioning is that, since there are more divisions, it is easier to develop a design that is globally optimized.
- E. #1 For a large group, the number of possible communication interactions is approximately proportional to the factorial of the number of group members.
- #2 For a large group, the number of possible communication interactions is approximately proportional to the square of the number of group members.
- F. #1 Performance-standard based development allows for more design creativity than does design-standard based development.
- #2 Performance-standard based development is easier to regulate than is design-standard based development.