

Name: _____

Recitation Section: L _____

Student Number: _____

1. Check that your exam includes all 7 pages (cover, 6 problems). Additionally, there is a 2-sided formula sheet, and interest rate tables for 6% and 8%.
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. For all multiple choice questions, select the closest, or most appropriate, answer. Answers without supporting calculations may be discounted.
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 55 minutes. Point values are listed for each problem to assist you in best using your time.

_____	Problem 1.	(20 points possible)
_____	Problem 2.	(24 points possible)
_____	Problem 3.	(9 points possible)
_____	Problem 4.	(13 points possible)
_____	Problem 5.	(24 points possible)
_____	Problem 6.	(10 points possible)
_____	TOTAL.	(100 points possible)

Manufacturing-Related Formulas

$$C_p = (USL - LSL) / (6 \sigma) \quad C_{pk} = C_p (1 - k)$$

$$k = | \text{Actual Mean} - \text{Target Mean} | / ((USL - LSL) / 2)$$

$$\text{First-time yield, FTY} = e^{-dpu}$$

$$\text{Prob \{ k defects \}} = (dpu^k / k!) e^{-dpu}$$

Name: _____

Student #: _____

Problem 1. (20 points)

A company is considering two different types of 100 horsepower motors to operate a large assembly line. The motors are scheduled to be in service for 10 years, and both will deliver the same operational characteristics for the assembly line. At the end of the tenth year, the equipment will be returned to the manufacturer, with a predetermined salvage value. An interest rate of 6% is to be used. Determine the equivalent present value of the lifetime operating cost of each motor, including maintenance, electricity and salvage value, and then determine the cheapest motor. The purchase prices of both motors are equal, so that does not need to be considered. Show all calculations and factors. Factor calculations may be shown in space to right.

Motor #1

Maintenance \$4,000 per year.
Electricity: \$2,000 per year for years 1-6, \$5,000 per year for years 7-10
Salvage value of \$600 at end of tenth year

Motor #2

Maintenance-Single payment contract, \$25,000, payable at end of first year.
Electricity: \$5,000 first year, decreases \$100 per year.
Salvage value of \$800 at end of tenth year

Motor #1

(9 pts.)Cost= _____

Motor #2

(9 pts.)Cost= _____

(2 pts.)Cheapest Motor # _____

Problem 2. (24 points)

Answer the following multiple choice questions by circling the letter in front of the most appropriate response.

- A. The project completion time for a PERT Chart is assumed to be a normally distributed random variable. This assumption is most closely related to the concept that
- (a) each activity is assumed to have both a shortest and a longest time for completion.
 - (b) the individual activity times are uncorrelated random variables, and the central limit theorem applies to the sum.
 - (c) the float is zero along a critical path.
 - (d) the earliest and latest starts are uncorrelated random variables.
 - (e) the critical path is the longest path from start to finish.
- B. A utility company sometimes adjusts the cost of power if a purchaser adjusts the load power factor because
- (a) The load power factor needs to match that of the line.
 - (b) Line losses can be reduced.
 - (c) It is desirable to have a large line current.
 - (d) A highly efficient motor is expensive to operate.
- C. The rooftop portion of the Quality Function Deployment diagram indicates primarily
- (a) which product characteristics are most important to the consumer
 - (b) which engineering attributes are the result of which stated consumer desires
 - (c) The tradeoffs and correlations among the engineering characteristics
 - (d) The engineering characteristics that cause the most difficulty in manufacture.
- D. It is proposed that a motor, with purchase price of \$50,000, is to be paid in 9 equal annual payments, the first payment occurring immediately. Determine the amount of each payment, assuming an interest rate of 8%.
- (a) \$5,556
 - (b) \$7,411
 - (c) \$7,451
 - (d) \$8,004
 - (e) \$8,701
- E. Which citation-sequence system are ECE students required to use when writing research papers and other engineering documents?
- (a) MLA
 - (b) CBE
 - (c) IEEE
 - (d) CMS

Name: _____

Student #: _____

F. A manufacturing process has an average defect rate of 1.4 defects per unit. Determine the probability that a particular unit will have greater than one defect.

- (a) 24.2%
- (b) 24.7%
- (c) 34.5%
- (d) 40.8%
- (e) 59.2%

G. Which of the following is not a typical characteristic of a profession?

- (a) shared body of knowledge
- (b) self-regulating
- (c) most members self-employed
- (d) some element of peer review in the evaluation process

H. A manufacturing process step, involving testing with perfect repair and 100% coverage, has a first-time yield (FTY) of 75%. While producing 1000 good units, approximately how many total tests will have to be performed?

- (a) 301
- (b) 1,288
- (c) 1,352
- (d) 2,877

Problem 3. (9 points)

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

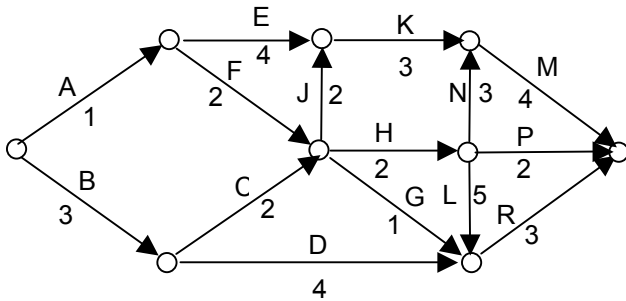
- A. #1 A fundamental problem with design for recyclability is that technology changes may render the modular components obsolete.
#2 A fundamental problem with design for recyclability is the expense in separating mixed materials.
- B. #1 The university was unable to settle the dispute between the two students.
#2 The affect of the storm in Oregon was dramatic.
- C. #1 There were less students registered for the afternoon laboratory section.
#2 Birmingham is less than 500 kilometers from Atlanta.

Name: _____

Student #: _____

Problem 4. (13 points)

- A. (7 points) Determine the critical path, and its duration, for the following CPM chart. State the path in terms of activity letters in order from start to finish. Example: AEKM, duration=12



Path and Duration _____

- B. (6 points) Determine the float for

(i) Activity K

Float K = _____

(ii) Activity H

Float H = _____

Name: _____

Student #: _____

Problem 5. (24 points)

For each of the following statements, circle either TRUE or FALSE.

- A. For the accelerated cost recovery method of depreciation, if the actual working life doubles, the first year depreciation expense charged decreases. **TRUE** **FALSE**
- B. To construct a prototype, the design must be modular in nature. **TRUE** **FALSE**
- C. Regular semiannual payments occur four times more often than do regular biennial payments. **TRUE** **FALSE**
- D. When the Payback Period method of project comparison is used, future investment returns are related to the initial cost using the P/F factor. **TRUE** **FALSE**
- E. The effective rate of interest is usually greater than the nominal rate for a given calculation. **TRUE** **FALSE**
- F. In group decision-making, the number of possible communication interactions is linearly proportional to the number of group members. **TRUE** **FALSE**
- G. The general structure of all critiques (engineering, music, movie, academic/non-academic) is similar. **TRUE** **FALSE**
- H. For the afternoon portion of the Fundamentals of Engineering Exam, one must take a discipline specific exam. **TRUE** **FALSE**

Problem 6. (10 points)

A batch of 10,000 inductors has a target mean of 1.2×10^{-4} henrys inductance and a lower specification limit of 1.0×10^{-4} henrys, with no upper specification limit. The produced batch has an actual mean inductance of 1.1×10^{-4} henrys, with a standard deviation of 5.0×10^{-6} henrys.

Determine the number of defective inductors _____