

CEE518 Quiz 3 Spring 2007

Your name \_\_\_\_\_

Open book, notes

9:30-10:30 AM More 226 Tuesday June 5<sup>th</sup>

Show all work for full credit. There are TWO problems on this quiz.

**1. (25 points) Systems reliability.**

Consider a series system of  $n$  components. If each of the components has identical reliability of 0.6, calculate the system reliability for

- $n=1$
- $n=2$
- $n=5$
- $n=10$ .

Consider a parallel system with  $m$  subcomponents. Each of the subcomponents has identical reliability of 0.6. Calculate the system reliability for

- $m=1$
- $m=2$
- $m=5$
- $m=10$ .

Comment on the results.

**2. Column Load and Resistance Factor Analysis (75 points total)**

The axial strength  $P_{\text{capacity}}$  of a building column is normally distributed with mean 336 kN and coefficient of variation 25 percent. The total column load is the sum of several components: live, dead, wind and snow load. These are assumed to be normally and independently distributed with means and COV as follows:

Factor	Mean (kN)	Coefficient of variation
Live	70	0.15
Dead	90	0.05
Wind	30	0.30
Snow	20	0.20

- Find the reliability index and the probability of failure of the column. (25 points)
- Estimate the resistance  $[\phi]$  and load  $[\gamma]$  factors for this design. (50 points)  
Assume that nominal loads are two standard deviations above the mean and nominal resistances two standard deviations below the mean.