Notes:
1. The exam is closed-book and closed-notes.
2. You are allowed one 8.5" x 11" sheet of notes and Z-transform tables.
3. Show work for partial credit.
4. There are a total of 4 problems.

1. \[ e(t) \xrightarrow{\text{Z.O.H}} e^x(t) \text{ and phase spectrum of } e(t), e^x(t) \text{ and } m(t). \]
   Draw the magnitude spectrum of \[ e(t), e^x(t) \text{ and } m(t). \]
   Label the values on your plots.

2. \[ r(t) + \quad \xrightarrow{\text{Z.O.H}} \quad C(t) = \frac{1}{s(s+1)} \]
   \[ = 0.4 \text{ sec} \]

(a) Find \[ \frac{C(z)}{R(z)} \text{ in terms of } G(z) \]

(b) Find \[ G(z) \text{ using the Z-transform tables}. \]

(c) Using the result of part (b), find \[ \frac{C(z)}{R(z)} \text{ in the simplified form}. \]

(d) Find \[ C(z) \text{ if } r(t) = u(t) \]

(e) Find the initial and final values of the output to unit step input using the result of part (d).

(f) Find \[ C(T), C(2T) \text{ and } C(3T) \]
3. \[ r(t) \xrightarrow{\text{T=0.1 sec}} g(s) \xrightarrow{Z. O. H.} c(t) \]

Find \[ \frac{C(Z)}{R(Z)} \]

4.\(a\) \[ \frac{M(Z)}{E(Z)} = \frac{2Z-1.5}{Z-1} \]

Find the difference equation.

4.\(b\) Given \(2e^{(kt)} - e^{(k-1)t} = m(bt)\)

Find \[ D(Z) = \frac{M(Z)}{E(Z)} \]

4.\(c\) Given \(x(t) = (e^{-at} - e^{bt}) u(t)\)

Find \(X(Z)\) using residue method.