Unified Engineering Problem Set **Lectures: M11, M12**
Week 7 Fall, 2007 **Units: M2.1, U-A (part)**

M7.1 ***(5 points)*** Write out the following tensor equations in full. ***Show all appropriate steps.***

(**Note:** these equations do not necessarily have any real meaning)

(a) $C_{mn} = R_{mnjk} \, z_k$ (for m = 1, n = 3)

(b) $E = 1/2$

(c) $H_i = b$ P n_i

(d)

(e) $f_{pq} \, (\partial g_q / \partial t) + x_p = 0$

M7.2 ***(5 points)*** Write out the succinct tensor equation that describes the following notation. Clearly explain all steps in arriving at the equation.

$$\begin{Bmatrix} M_1 \\ M_2 \\ M_3 \end{Bmatrix} = \begin{bmatrix} & & 2 \\ & & 2 \\ & & 2 \end{bmatrix} \begin{Bmatrix} T_{11} \\ T_{22} \\ T_{12} \end{Bmatrix}$$

M7.3 ***(10 points)*** A second axis system is defined by rotating the x_1- x_2 plane by an angle θ of $-25°$ about the x_3 axis. A position vector, $\underline{r}$, is described in the original axis system as (NOTE: The vector is unitless):

$$\underline{r} = 4\,\underline{i}_1 - 3\,\underline{i}_2 - 5\,\underline{i}_3$$

(a) Determine the expression for the vector in the rotated coordinate system.

(b) Prove, by some means, that these two expressions are equivalent.