SPRING 2025 - APPLIED TOPICS - FINAL

All honorable references OK. Due midnight Apr 29 by e-mail to tbeatty@fgcu.edu. All problems equal value.

1) Write down the correct transformation law for mapping the three dimensional tensor T^{ijk}_{lm} to T^{rst}_{uv}.

2) Write the following 2nd rank four dimensional tensor as the sum of a symmetric tensor plus an anti-symmetric tensor:

$$\begin{bmatrix} 2 & 5 & 4 & 7 \\ 0 & 2 & 6 & 6 \\ 3 & 5 & 7 & 8 \\ 4 & 3 & 2 & 9 \end{bmatrix}$$

3) If the xyz coordinate system is rotated $+60^o$ around the z-axis, and then $+45^o$ around the x' axis (the new x axis after the original rotation), what are the new final components of the original vector $\langle 1,1,1 \rangle$?

4) Find the area of the hypocycloid given by $x^{2/3} + y^{2/3} = 4$

5) A force field is given by $F(x,y,z) = \langle 2xz^3 + 6y, 6x - 2yz, 3x^2z^2 - y^2 \rangle$. Find the total work done against this field along the path from $(1,1,1)$ to $(2,2,2)$ to $(3,4,5)$ and back to $(1,1,1)$