FINAL EXAM – March 23, 2023 12:00 pm – 1:50 pm

This exam is closed book and closed notes except for the equations below. Show your work and explain your reasoning. Please do all your work in the blue books. **Only the blue books will be graded!**

There are 5 main parts with a total of 200 points possible on this exam.

Budget your time wisely! Not all questions are of equal difficulty.

Useful Formulae:

$$\sin(a\pm b)=\sin a\,\cos b\pm\cos a\,\sin b \qquad I=\tfrac{1}{2}\varepsilon v|E|^2 \qquad \cos(a\pm b)=\cos a\,\cos b\mp\sin a\,\sin b$$

$$\mathbf{k}\times\mathbf{E}=\omega\mathbf{B} \qquad n_i\sin\theta_i=n_t\sin\theta_t \qquad \sin\theta\cong\theta-\frac{\theta^3}{3!}+\dots \qquad \cos\theta\cong1-\frac{\theta^2}{2!}+\dots$$