Knowledge of mechanics, electricity and magnetism at the level of Physics 2-series is required for this course. Basic knowledge of calculus (for example, how to take derivatives, do simple integrals) will be needed throughout the course. You need to know what differential equations are and how to solve the very simple ones, but you will not have to solve complicated ones. Having taken PHYS 2B and MATH 20D is a requirement, but it still does not mean you are ready for this course since you may have taken these courses a long time ago and forgotten many things, or you may not have learned well the parts that are essential for this course.

Here is a quick checklist to help you determine if you have the knowledge required for this course. It will also help you determine the materials you need to refresh your knowledge on if you need to.

These are things that you must recognize **at once**! You must have done many problems using these:

1. $\vec{F} = m\vec{a}$
2. $\vec{p} = m\vec{v}$
3. $K.E. = \frac{mv^2}{2}$
4. $P.E. = \frac{kx^2}{2}$
5. $\omega = 2\pi f$
6. $F = k\frac{q_1 q_2}{r^2}$
7. $\vec{F} = q\vec{E}$
8. $P.E. = k\frac{q_1 q_2}{r}$
9. $\vec{F} = q\vec{v} \times \vec{B}$

Here are some simple problems that you should be able to do easily:

1. The distance between cities A and B is $200km$. Car 1 leaves A towards B at the same time as car 2 leaves B towards A. The speed of car 1 is $20m/s$, the speed of car 2 is $25m/s$. What is the speed of car 2 with respect to car 1? How much time (in hours) will it take until they meet?
2. Take the derivative of $5\sin(3x^2 + 4x + 2)$
3. $\int x^3 dx$
4. $\int_{-\pi/2}^{\pi/2} (\cos(5x) + \sin(2x))\, dx$

These are some problems you should be able to do, but you may need to think about them for a little while or use a textbook if you need to:

1. Verify that $x(t) = e^{-\alpha t}$ is a solution of the differential equation $\frac{dx}{dt} + \alpha x = 0$.
2. Give a solution of the differential equation $\frac{d^2x}{dt^2} + \omega^2 x = 0$ where $x = x(t)$. Any ideas what the general solution looks like? *Hint: Where in physics may have you seen this equation? What is ω?*
3. $\int \frac{\ln x}{x} dx$ *Hint: Use u-substitution.*