Outline for Exam 1

1. Coulomb’s Law: how to apply to collections of point charges
2. Insulators vs conductors
3. Electric fields: definition, visualizing with lines of force, calculating for collection of point charges and for simple continuous objects
4. Scalars fields and partial derivatives: $\frac{\partial z}{\partial x}$ and $f_x$ notation, computation, interpretation, chain rules
5. Directional derivatives: $D_u f(x,y)$ notation, computation, interpretation
6. Electric potential energy: connection with work done by electric force and by external force to assemble charges
7. Electric potential: definition and significance, equipotential surfaces
8. Gradient: $\nabla f(x,y)$ notation, use in writing directional derivatives, significance of direction and magnitude, application to finding direction of largest and smallest and zero directional derivatives, application to finding the largest and smallest directional derivative, relationship to level curves and level surfaces, application to finding normal lines and tangent planes
9. Electric potential and potential energy of collection of point charges
10. Finding electric field from electric potential: $\mathbf{E} = -\nabla V$
11. Conservative vector fields: definition in terms of gradient, independence of path for line integrals, how to find scalar potential functions and their use in computing line integrals
12. Finding $V$ due to continuous charge distributions
13. Surfaces: parametric descriptions, normal vectors
14. Surface integrals of scalar fields: computation methods, applications to mass density problems and to surface area

Be familiar with all assigned homework and ideas from the labs.