Physics 230
Topics to study for Final Exam

Series:
Conditions for series convergence
Series expansion of various functions

Complex Variables:
Poles and essential singularity
Calculation of residue using the general formula, and series expansion of the function
Calculation of residue for pole of order one
Calculation of three integral types with integrand $F(\sin x, \cos x)$, $F(x)$, $f(x)e^{iax}$
Calculation of integrals with singular points on $x$ axis

Legendre Function
Generating Function, Recurrence formulas, differential Equation, orthogonality
Expansion of $1/|x_1-x_2|$ in terms of Legendre function
Solution of Laplace Equation for Spherical Coordinate case
Electric potential at points off the symmetry axis from the knowledge of potential on symmetry axis (ring of charge, disk of charge, and finite length rod for both $r<a$ and $r>a$)

Bessel Function
Generating Function, Recurrence formulas, differential Equation, orthogonality
Solution of Laplace Equation for Cylindrical Coordinate

Fourier Series
Fourier series expansion of various functions
Application of Fourier series for calculation some series sum

Fourier Transform
Calculation of Fourier transform of functions
Calculation of inverse Fourier transform of functions
Fourier transform of derivative (order $n$) of a function
Solution of differential equations using Fourier transform, e.g. wave equation, heat transfer, and neutron diffusion
Parseval relation and its applications, e.g. integral calculation

Laplace Transform
Calculation of Laplace transform of functions
Calculation of inverse Laplace transform of functions
Laplace transform of derivative (order $n$) of a function
Solution of differential equations using Laplace transform, e.g. harmonic oscillator

Some Partial Differential Equations in Physics
Solution of partial differential equations using separation of variables and Fourier transform
circular and rectangular membrane oscillation, 1D string oscillation