1. Angular momentum operator. Commutation relations.
2. Square of angular momentum operator L^2 . Commutation relations between L^2 and L_z .
3. Representation of L^2 , L_x , L_y and L_z operators in spherical coordinates. Eigenvalue problem for L_z. operator. Magnetic quantum number. Normalizing the wave function(derive).
4. Eigenvalue problem for operator L^2. Spherical function. Legendre polynomial. Orbital quantum number. Relation between orbital and magnetic quantum numbers. Normalizing the spherical wave function.
5. Schrodinger equation for Hydrogen atom. Representation of general solution (wave function).
6. Equation for the radial part of wave function for Hydrogen atom. Method of solution. Laquerre polynomial.
7. Normalizing of radial part of total wave function. Energy of electron. Spectral series of Hydrogen atoms (Lyman, Balmer, Paschen,...). Calculation of wave length for different spectral lines.
8. Bohr radius. Calculation by semiempirical Bohr theory and by quantum mechanics.
9. Degenerate of levels. Order of degeneration of energy levels for Hydrogen atoms. A simple model that includes the influence of internal electrons of alkali metals on a valence electron. Elimination of degeneracy. Periodic table of elements.
10. Time independent perturbation theory(non degenerate case). First order approximation. Corrections for energy and wave function.
11. Time independent perturbation theory. (non degenerate case). Second order approximation. Corrections for energy and wave function.
12. Harmonic oscillator in the field of constant external force. Correction of energy byperturbation theory. Anharmonic oscillator. Correction of energy for cubic perturbation of potential energy($\alpha \cdot x^3$).
13. Time independent perturbation theory(degenerate case). First order approximation. Secular equation. Corrections for energy. Calculation of wave functions.
14. Stark effect and simple Zeeman (electron with zero spin) effect for Hydrogen atom.
15. Time dependent theory. Schrodinger equations for non perturbed stationary task after the applying the time-dependent perturbation. Representation of wave functions.
16. The equation for the time-dependent expansion coefficients of the wave function. Physical interpretation of this coefficients.
17. The solution of time-dependent perturbation theory for small perturbation. First order approximation. Physical interpretation of results.
18. The time-dependent perturbation theory for small harmonic perturbation. Transition probability for long time and per time unit.
19. The time-dependent perturbation theory for an atom in an external harmonic electromagnetic wave. Perturbation Hamiltonian. Transition probability for dipole moment of electron. Induced and spontaneous transitions and their probabilities. Einstein theory of radiation.